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Recent Progress of Cobalt Silver Mines

By Reginald E. Hore*

Cobalt silver mines had another very profitable year in 1912, netting the owners over $10,000,000 on a production of about 30,000,000 oz. having a gross value of about $17,000,000. During the year $8,179,468 was distributed in dividends. The output was somewhat lower than in 1911, but the average selling price was considerably higher and costs remained about the same. The output for previous years is shown by the accompanying table from the report of the Deputy Minister of Mines, Thomas W. Gibson. The mines have now produced a total of about 156,000,000 oz. silver valued at more than $82,000,000. After the year's operations most of the mines have as much ore in sight as in 1911 and should be large producers in 1913. Two or three of the producers, however, have very little in reserve and will probably show serious falling off unless new discoveries of high-grade ore are made.

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Two properties, Cobalt Townsite and Cobalt Lake, have shown great improvement during the last two years. They paid dividends of $220,000 and $310,000 in 1912 and are expected to increase production in 1913. Nipissing, the largest producer, had a highly successful year and was able to build a costly low-grade mill out of profits without decreasing the dividends; $1,800,000 was distributed to stockholders during the year. Coniagas met with like success in mining and developing, and paid to stockholders $1,440,000 without decreasing the known reserves. Crown Reserve held its own and was able to pay $1,080,000 to shareholders. McKinley-Darragh-Savage found some unusually rich ore and distributed $898,000 from profits. La Rose did not develop as much new ore as was hoped and the market value of shares fell to new low levels, but the company was able to pay 12% on its capitalization of $7,500,000 without decreasing the large surplus.

Buffalo paid $320,000 and built a new amalgamation-cyanidation plant. Kerr Lake, supposed to have seen its best days, paid $600,000 and still has rich ore in reserve. Timiskaming has a profitable year, paying $300,000 to stockholders, but as compared with some former years,

Main Shaft and Mill, Coniagas Mine, Cobalt, Ont.

Cobalt, from Nipissing Mine, Looking across Cobalt Lake

TABLE OF DIVIDENDS PAID BY COBALT SILVER MINING COMPANIES

Name of Company	Authorized Capital	Capital Stock Issued	Par Value	Dividends Paid 1911	Dividends Paid 1912	Total dividends paid to end of 1912
Beaver	2,000,000	2,000,000	1	$170,000	$180,000	$350,000
Buffalo Mines	1,000,000	1,000,000	1	440,000	270,000	1,617,000
City of Cobalt	1,500,000	1,500,000	1	.....	.....	138,375
Cobalt Central	5,000,000	5,000,000	1	.....	.....	192,845
Cobalt Lake	4,374,885	3,304,051	1	.....	310,000	310,000
Cobalt Silver Queen	1,500,000	1,500,000	1	.....	.....	315,000
Cobalt Townsite	1,000,000	1,000,000	1	.....	220,000	220,000
Coniagas	800,000	800,000	5	1,440,000	1,440,000	4,280,000
Crown Reserve	2,000,000	1,768,814	1	1,238,186	1,061,288	4,687,373
Foster Cobalt	1,000,000	915,588	1	.....	.....	45,000
Kerr Lake	600,000	600,000	5	990,000	600,000	4,320,000
La Rose	1,500,000	1,498,407	5	599,451	711,847	4,434,042*
McKinley-Darragh-Savage	2,500,000	2,247,692	1	1,123,666	899,769	2,831,757
Nipissing	1,200,000	1,200,000	5	1,800,000	1,800,000	9,090,000
Right of Way	2,000,000	1,685,500	1	33,710	.....	526,904
Temiskaming and Hudson Bay	25,000	7,761	1	116,451	209,847	1,706,520
Timiskaming	2,500,000	2,500,000	1	225,000	300,000	1,309,156
Trethewey	1,000,000	1,000,000	1	200,000	200,000	971,999

*Includes profits shared privately before incorporation.

has little high-grade in reserve. The same is true of the O'Brien mine. Beaver has been prosperous recently and is meeting with some success at greater depth than other Cobalt mines. The Temiskaming & Hudson Bay mine increased production and profits and paid dividends amounting to $209,000. Trethewey paid 10% but has little high-grade in reserve. Casey-Cobalt increased production, profits and reserves and should be a larger producer in 1913. The Drummond again found rich ore and should yield good profits for some time. Like the O'Brien, the Drummond mine is privately owned.

The most noteworthy discovery during 1912, aside from ore discovered on property of the large producers, was made by the Seneca-Superior. This company, operating on a lease from Peterson Lake Mining Co., opened a vein of high-grade ore under Cart Lake. A few shipments have been made and the property promises to be profitable.

While paying out handsome dividends during the last few years, the mines at Cobalt have also paid for construction of a large number of well equipped mills and cyanide plants. There are at Cobalt 17 mills with a total capacity of about 1800 tons per day. Remarkable progress in treating the unique ore has been made. Straight concentration methods have been so adopted that a good recovery is now being made from low-grade ore. Cyanide methods have also proven suitable and the Nipissing company has just put in operation a plant of 200 tons daily capacity for the treatment of low-grade ore by cyanide. The Nipissing has in operation a remarkable process for treating the high-grade ore. The crushed ore is ground with mercury and cyanide solution in a tube mill and most of the silver amalgamates with the mercury. The silver is recovered and refined on the property and the bullion shipped is of high purity. A plant to treat ore in a similar way has been constructed during the year by the Buffalo Mines, Limited.

TOTAL PRODUCTION, COBALT MINES, 1904 TO 1911

Year	Shipments of Ore and Concentrates, Tons	Nickel Tons	Nickel Value	Cobalt Tons	Cobalt Value	Arsenic Tons	Arsenic Value	Silver Ounces	Silver Value	Total Value
1904	158	14	$3,467	16	$19,960	72	$903	206,875	$111,887	$136,217
1905	2,144	75	10,000	118	100,000	549	2,693	2,451,356	1,360,503	1,473,196
1906	5,335	160	....	321	80,704	1,440	15,858	5,401,766	3,667,551	3,764,113
1907	14,788	370	1,174	739	104,426	2,958	40,104	10,023,311	6,155,391	6,301,095
1908	25,624	612	....	1224	111,118	3,672	40,373	19,437,875	9,133,378	9,284,869
1909	30,677	766	....	1533	94,965	4,294	61,039	25,897,825	12,461,576	12,617,580
1910	34,282	604	....	1098	54,699	4,897	70,709	30,645,181	15,478,047	15,603,455
1911	26,653	392	....	852	170,890	3,806	74,609	31,507,791	15,953,847	16,199,346
Total	139,661	2893	$14,641	5901	$736,762	21,697	$306,288	125,971,971	$64,322,180	$65,379,871

Freight Rates on Mining Machinery from Butte Unchanged

In the case of the Railroad Commission of Montana vs. the Northern Pacific Ry. Co., the Interstate Commerce Commission has considered the rates on mining machinery in carload and less than carload quantities from Butte, Mont., to various points in Idaho and Washington.

FREIGHT RATES FROM BUTTE TO WESTERN POINTS

From Butte to	Miles	Carload, Class A per 100 Lb.	Less than Carload, per 100 Lb. Classes 1	2	3	4
Wardner, Idaho	166	$0.64	$1.28	$1.09	$0.90	$0.77
Mullan, Idaho	248	0.60	1.20	1.02	0.84	0.72
Wallace, Idaho	255	0.61	1.22	1.04	0.85	0.73
Rathdrum, Idaho	350	0.75	1.50	1.28	1.15	0.90
Spokane, Wash.	377	0.78	1.54	1.31	1.08	0.92

The commission holds in substance that it cannot base its orders on mere rate comparisons pointed out from tariffs on file and therefore it dismisses the case without prejudice. The rates at present levied are as given in the accompanying table.

In general the commission takes the following view with respect to the transportation of mining machinery:

"As mining machinery takes class rates, any reduction on that article of traffic would have to be in the class rates as a whole or by taking this machinery out of the classification and giving it a commodity rating. Certainly upon this record we would not be justified in the former course; nor is there any justification for the latter."

Wilfley Patent Again Upheld

The Deister table is held to be an infringement on the Wilfley patent in a decision rendered by Judge Richard E. Sloan, Jan. 14, 1913, in the District Court of the United States for the district of Arizona. Suit was brought by the Mine & Smelter Supply Co. against the Detroit Copper Mining Co., of Arizona, and the Arizona Copper Co., as users of Deister tables, and a decision favorable to the plaintiff obtained.

It was urged by the defendants that the Wilfley patent specifications limited the invention to a combination of riffles with "a smooth or unriffled surface." The court, however, held that, being an invention successfully introducing a new principle, it should not be limited strictly to the precise arrangement specified, and that the deflected ends of the Deister riffles performed the same function as the smooth unriffled portions of the Wilfley table. The specific point of infringement noted by the court is that the arrangement of riffles on the Deister table is the equivalent of the advancing terminals on the Wilfley.

These were the first suits brought by the holders of the Wilfley patents against users of the Deister tables, and, consequently, this is the first decision against such users.

Algomah Mining Co.

The report of the directors of the Algomah Mining Co., for the year 1912, shows a total expense at mine of $43,057. This company suffered a loss of $28,725 on account of the failure of Stephen R. Dow, a former president of the company. This sum represents the amount, with interest, that should have been in the treasury at that time. The assignee of Mr. Dow reports practically no assets. To meet the expenses of continuing exploration at the property from Aug. 1 to Dec. 31, $12,000 was borrowed and this amount is being increased at the rate of approximately $3000 per month. Work at the mines consisted altogether of development and exploration, and, up to this time, no production is being made.

Replacement Deposits in the Ajax Mine

By E. A. Colburn, Jr.*

SYNOPSIS—Large, irregular orebodies were formed at this Cripple Creek mine by metasomatosis of granite at its contact with a volcanic breccia. Several narrow veins continue downward from the lowest of the irregular deposits. Phonolite and basalt dikes which occur are more recent than the ore and could not have governed its deposition.

The Ajax mine, situated on the southern slope of Battle Mountain, just above the town of Victor, Colo., in the Cripple Creek mining district and in close proximity to the Portland, Strong, Granite and other producing mines, shows many interesting geological occurrences not common to its neighbors or, in fact, to the other mines in the district; among them the replacement orebodies in the granite formation may be of the most interest on account of their large size, irregular shape, lack of definite walls, and the difficulty with which they are followed in the course of mining operations.

Granite-breccia Contact Traverses the Property

The property includes within its boundaries both the granite and the volcanic breccia, their contact traversing the surface in an approximately east and west direction until at a point a little way from the west boundary line it takes a decided bend to the north. Its dip averages approximately 70° N for the first 600 ft. in depth and then flattens until a dip of 45° N is reached; it may be noted also that the contact shows no decided, clean-cut wall below the 600-ft. level, as it does on the upper levels, but on the contrary is greatly broken up, large bodies of granite being found as far as 200 ft. out in the breccia. This condition is more noticeable toward the western part of the property where the contact takes its northerly turn. The main shaft starts in the breccia at a point a few feet north of the contact and passes into the granite at the second level, continuing in it from there down.

Phonolite and Basalt Dikes Cut Both Formations

Both the breccia and the granite are cut by numerous dikes, phonolite and basalt being well represented. The prevailing strike of the fissured zones and the dike intrusions seem to be, with one or two notable exceptions, N 30° W, their dip varying from 60° to 80° SW. The basalt dike, which is opened on every level from the 1100-ft. to the surface, has an almost due north and south course and dips about 84°; it is from two to four feet in width and has a platy parting, containing calcite in small sandy particles. This dike often feathers out but can usually be found again by crosscutting a few feet to either the right or the left. It seems to be a later intrusion than any of the other dikes, as it cuts them all as it also does all the veins.

The No. 1 NE and No. 2 NE phonolite dikes are the only ones not conforming to the usual course of N 30° W; they strike about N 45° E and dip 70° NW. They converge and form one dike a few feet north of the shaft on the lower levels and assume an extremely crooked course toward the northeast, cutting through into the breccia about 200 ft. from the shaft. All the phonolite dikes, as well as the basalt, cut across the contact with no apparent faulting or disturbance except that occasionally they send out prongs and thin sheets to small distances along the contact. The dikes mentioned are all in or near the ore in this part of the mine and may be readily traced on the plans of the 600-ft. and the 700-ft. levels, shown in Fig. 3 and Fig. 2 respectively.

The Ore Is a Replacement of the Granite

The ore in the granite has been largely formed by the replacement of the mica, quartz and other minerals by secondary quartz, fluorite, pyrite, crystals of calaverite in bunches and seams and a green mineral thought by the U. S. Geological Survey[1] to be roscoelite. The pink microcline in the granite has not been altered to any considerable extent and remains as pink masses, distinct against the green ground of the secondary minerals. The ore can readily be distinguished from the surrounding granite waste by the green color, the large number of vugs and the irregular fracture common to this class of ore, but its value cannot be ascertained without assaying, the latter fact being true of most of the ore mined in the Cripple Creek district.

Large Replacement Bodies between the 300- and 800-ft. Levels

As will be seen by reference to Fig. 1, a projection of the ore deposits on a northeast-southwest vertical plane approximately represented by the line *UV* in Fig. 2 and *XY* in Fig. 3, the orebodies may be divided into two classes: First, the large, irregular bodies; and second, the small veins extending, for the most part, downward from the lower end of the large shoot at the 700-ft. level. The large bodies are roughly elliptical in shape, about 30 ft. wide and from 40 to 60 ft. long, according to the pitch of the shoot along its longer axis.

The higher one of the deposits does not reach quite up to the 300-ft. level but fades into the granite about 20 ft. below the level. It is limited on the north by the contact between the granite and the volcanic breccia and fades out into the country rock at its other edges. The shoot on the 400 -ft. level is situated a few feet north and east of the shaft and is separated from the shoot on the 500-ft. level by less than 10 ft. of barren granite. Both the 400- and 500-ft. level stopes are cut by the No. 2 NE phonolite dike near their eastern edges but are not limited in this direction by the dike. Below the 500-ft. level the ore dips sharply to the west, passing through the shaft and pinching out against the basalt dike at a point 50 ft., below the level.

The main orebody seems to stop short at this point, but the *A* vein, here intersected by the basic dike, carries considerable quantities of ore in a northwesterly direction from the dike. This ore, however, does not extend upward to the 500-ft. level nor any deeper than the bottom of the ore in the big shoot, to be described later, with which it connects at the 600-ft. level and below. At the

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[1]Professional Paper No. 54, p. 483, U. S. Geological Survey.

floor of this level and on the west side of the basalt dike, this big oreshoot opens up again with no apparent connection, either by fissuring or faulting, between it and the one which ends at the 550-ft. level on the other side of the basalt dike.

The longer axis of the ore from here down has a northeasterly strike, the ore rising above the level, as it proceeds to the southwest, and descending along its intersection with the *C* vein to a point a few feet below the 700-ft. level, where the ore splits into four small veins having a dip of about 70° SW. The large oreshoot, however, dips back again toward the shaft and ends a few feet below the 800-ft. level in close proximity to the basalt dike.

The ore is of a good grade and is accompanied by very little waste, except that occasionally a bar or bunch of granite is encountered which has not been entirely altered and is below the average grade of the ore in the stope.

The Several Small Veins Extend Down from the 700-ft. Level

Below the 700-ft. level (Figs. 1 and 2) the big shoot seems to split into a number of small fissures extending downward into the granite, namely, the *B* vein, the *C* vein, the *C* split vein, the *D* vein and the Mohican vein. The *E* vein lies parallel with these, but has no apparent connection with the big ore deposit.

In Fig. 2, a plan of the 700-ft. level, it will be seen that the *C* vein, the *C* split vein and the Mohican vein all connect, at their southern ends, with the big stope; the *B* vein connects with the big shoot a little way below the 700-ft. level, but does not carry ore through to their second intersection at the 600-ft. level.

As the *C* vein is the only one which has produced pay ore above the big shoot and the only small vein making ore on the contact at the 300-ft. level and above, it may be assumed that this vein was probably instrumental in the deposition of a large part of the ore in the big stope

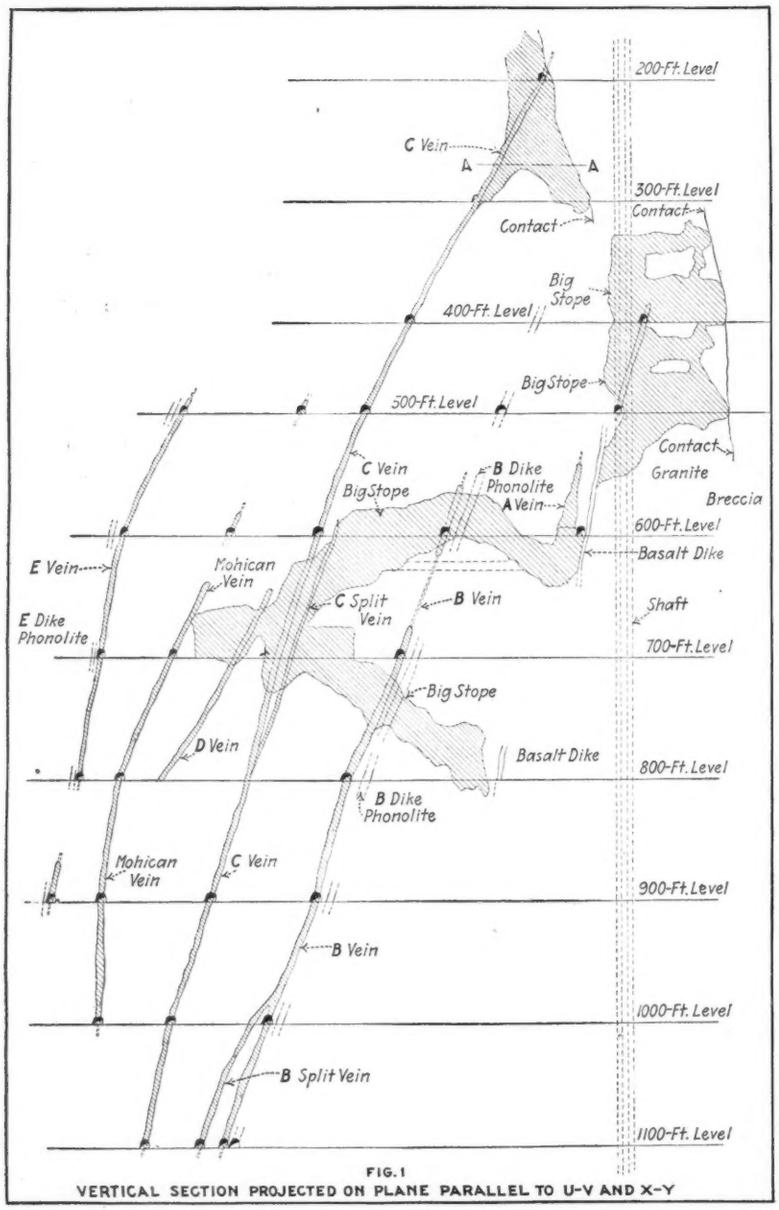

FIG. 1
VERTICAL SECTION PROJECTED ON PLANE PARALLEL TO U-V AND X-Y

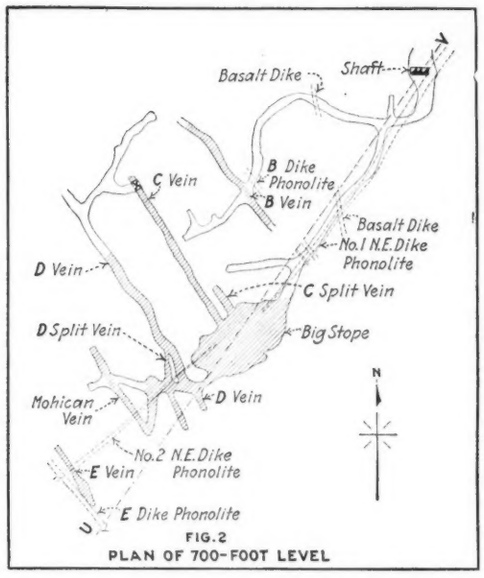

FIG. 2
PLAN OF 700-FOOT LEVEL

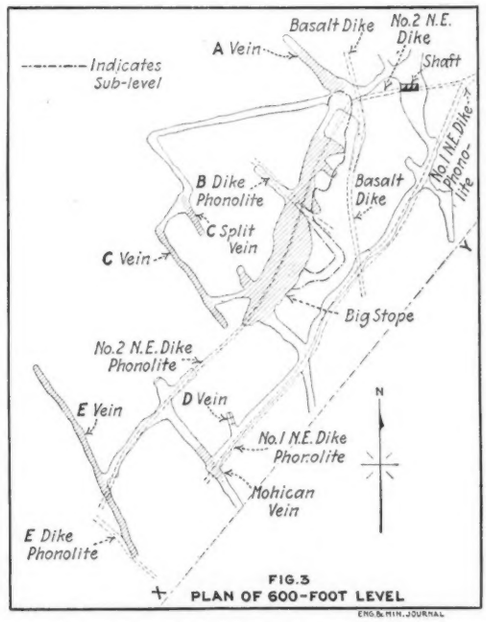

FIG. 3
PLAN OF 600-FOOT LEVEL

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PLANS AND CROSS-SECTION OF AJAX OREBODIES, CRIPPLE CREEK DISTRICT, COLORADO

below the 600-ft. level. The *C* vein also carries a higher grade of ore than the other small veins.

The narrow veins have been formed by the replacement of the granite country rock around one or more tight quartz seams and attain a width of from two to four feet and a length of not more than 100 ft. in their productive portions. A few feet beyond the ends of the oreshoots these veins become nothing more than small seams and often disappear altogether. On the lower levels the veins are much closer together than they are on the upper levels, and it is possible that at some greater depth they may unite to form one fissure. This condition has been realized on the 1100-ft. level, where the *B* and *C* veins have united a short distance south of their respective oreshoots. The granite on this level is notably dry, hard and compact, the veins showing the result of this condition in being smaller and shorter than on the upper levels, with no apparent effect, however, on the grade of the ore.

It seems probable that when the 1200-ft. level reaches the orebodies, they will be larger in extent than on the level above because of the fact that the ground, so far as opened on this level, is much more thoroughly fissured and broken than on any level below the 600-foot.

THE DIKES WERE FORMED SUBSEQUENTLY TO THE ORE

The *B* dike passes through the ore in two places, just below the 700-ft. and above the 600-ft. levels, and shows no evidence of fissuring or metamorphic action other than that common to it at other places.

Both the dikes No. 1 NE and No. 2 NE are probably splits from the same dike, as they come together at a point a few feet northeast of the shaft on the 600-ft. level (Fig. 3). On the 400-ft. and the 500-ft. levels the split is south of the main orebody, but from the 600-ft. to the 800-ft. levels the split lies north of the ore and both dikes intersect the ore at some point within this vertical distance.

Southwest of the big stope the dike No. 2 NE is about three feet wide and appears to be a strong, continuous dike, but as soon as it enters the ore it pinches to barely six inches in width and is followed with difficulty in places, being represented only by a knife-blade seam. It continues through the ore till it reaches the northeastern edge where it again assumes its normal size, turns sharply to the east, passes through the shaft and joins the No. 1 NE dike a little farther along. The No. 1 NE dike enters the ore on the 700-ft. level (Fig. 2), and pinches out entirely.

Neither of these two dikes has been noticed in the stopes below the 700-ft. level, and they have probably taken a sharp dip to the southeast away from the ore. It may fairly be assumed that these dikes were intruded at a period somewhat later than that covering the deposition of the ore, on account of the fact that where the dikes pass through the orebodies they show no signs of fissuring or mineralization. The fact that the dikes pinch out entirely or partially may be accounted for by the extreme toughness of the ore.

The theory advanced by the U. S. Geological Survey[1], in regard to the origin of the big oreshoots is, in brief, that the Nos. 1 and 2 NE dikes, at their intersections with the northwest fissures and the northeast fissure zone, banked up the solutions, allowing time for precipitation. In other words, the dikes had a large measure of control over the position of the deposits.

This seems hardly possible, as the same intersections produced no ore on the 500-ft. level except on the *C* vein, and that at quite a distance north of the dike. In order to have been of any aid in the deposition of the ore, the dikes must have been intruded prior to that time and would show some evidence of mineralization and fissuring, but such is not the case, and we would naturally infer that the dikes were forced up through the granite along the lines of greatest weakness, probably the northeast-southwest fissure zone, and when they reached the orebodies were contorted and pinched on account of the greater toughness and resistance of the ore.

[1]Professional Paper 54, p. 481, U. S. Geol. Surv.

Vitribestos Stack Lining

The smoke-stack of the First National Bank Building, Pittsburgh, Penn., which is 400 ft. high, is lined throughout with vitrified asbestos or "Vitribestos" to a thickness of two inches and presents a solid interior surface. It serves the double purpose of protecting the metal stack from sulphurous and other destructive acids and insulating it from great heat. These slabs of Vitribestos, 3 ft. by 6 ft. and 2 in. thick, weigh, with all attachments, only 30 lb. per cu.ft. in place, says *Power*, Feb. 25, 1913, or about 5 lb. per sq.ft. of stack area.

This building was designed to be 26 stories high, but only five stories were built in the original undertaking completed four years ago, and the original stack was lined as stated. When the remaining stories were completed, the stack was extended in 18-ft. sections, riveting all joints except at the ends of the sections, which were flanged joints. The 18-ft. sections were lined with Vitribestos before they were carried to the building, and were hoisted and set in place without interfering with the operation of the stack. When the last section was in place, the stack was lined, except at the open joints every 18 feet.

With the arrival of mild spring weather, these joints were sealed up and inspection showed that the material which had been in service for four years was in as good condition as when first applied. Vitribestos is manufactured by the H. W. Johns-Manville Co., of New York.

Geographical Distribution of Mining

In a paper on the geographical distribution of mining in the United States, presented to the American Institute of Mining Engineers at the February, 1913, meeting, E. W. Parker, of the U. S. Geological Survey, states that, including coal, the states east of the Mississippi River contribute 66% of the mineral output of the country, rated on a value basis. The center of production is found to be in Cass County, Ill., about 120 miles north of St. Louis.

In the same paper is made the remark that probably no mining industry, except perhaps gold dredging, works on so narrow a margin of profit as does coal mining. In 1909, the expense of producing bituminous coal was $395,907,026; the value, f.o.b. mine, $427,962,464; and the difference $32,055,438, or about 8.4c. per ton. For anthracite, the margin, figured in the same way, was 11.6c. per ton.

Worlds Production of Principal Metals

SYNOPSIS—An investigation into the rate of increase of production of copper, iron, lead and zinc (the chief commercial base metals) for the last 40 years. Gold production has ceased to increase rapidly, while if any of the first four mentioned is near a check in production it is lead.

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In the accompanying tables and the chart plotted from them we have shown the world's production of copper, lead, zinc, gold and iron since 1870, covering a period of 40 years. Statistics of gold and iron production going about 20 years further back are available, but it seemed to us best to begin our chart at about the time when reliable statistics for all these metals began to be summarized year by year. In the cases of lead and zinc this began in 1873; in the case of copper not until 1879. With respect to those metals there are figures for earlier years, but not consecutively.

WORLD'S PRODUCTION OF COPPER, GOLD, IRON, LEAD AND ZINC

Year	Copper, Metric Tons	Lead, Metric Tons	Zinc, Metric Tons	Gold, $	Iron, Metric Tons
1871	.....	.....	.....	107,000,000	13,874,315
1872	.....	.....	.....	99,600,000	14,861,974
1873	.....	297,570	137,560	96,200,000	15,170,115
1874	.....	331,150	153,155	90,800,000	13,994,179
1875	.....	352,791	169,532	97,500,000	14,140,081
1876	.....	349,464	179,432	103,700,000	13,807,343
1877	.....	333,226	200,518	114,000,000	14,073,446
1878	.....	353,499	206,878	119,000,000	13,352,605
1879	154,376	350,644	207,016	109,000,000	14,473,964
1880	156,404	352,742	218,252	106,600,000	18,626,160
1881	166,065	387,592	262,365	103,102,000	20,039,461
1882	184,620	407,021	278,596	102,000,000	21,461,867
1883	202,697	444,216	284,331	95,400,000	21,729,202
1884	223,884	437,224	298,614	101,700,000	20,150,042
1885	229,315	435,175	298,889	108,400,000	19,792,390
1886	220,699	447,906	298,860	106,000,000	20,862,989
1887	226,492	546,194	306,113	105,775,000	22,977,983
1888	262,285	635,341	321,791	110,197,000	24,016,705
1889	265,516	595,926	335,359	123,489,000	26,030,266
1890	274,065	586,603	347,200	118,848,700	27,431,229
1891	280,138	626,686	363,004	130,650,000	26,219,525
1892	309,113	645,435	374,772	146,292,600	25,978,619
1893	310,704	640,984	377,915	158,437,551	25,266,746
1894	330,075	617,654	384,207	182,509,283	25,847,352
1895	339,994	650,580	413,175	198,995,741	29,354,597
1896	384,493	676,662	425,711	211,242,081	30,850,412
1897	412,818	721,167	444,802	237,833,984	33,451,220
1898	441,282	777,314	468,795	287,327,833	36,555,361
1899	476,194	738,296	491,174	311,505,947	40,447,900
1900	491,435	770,082	478,532	258,829,703	41,028,479
1901	529,508	806,370	516,019	260,877,429	40,950,692
1902	542,606	816,926	552,356	298,812,493	44,342,579
1903	630,590	818,307	570,262	329,475,401	47,113,730
1904	693,240	847,588	622,161	349,088,293	46,069,501
1905	698,931	884,986	654,118	378,411,754	54,054,783
1906	715,510	896,342	699,668	405,060,969	59,074,861
1907	724,120	939,321	738,210	416,101,196	60,680,014
1908	758,065	960,380	719,155	443,355,856	48,640,479
1909	854,758	1,003,243	784,199	458,424,058	61,217,064
1910	877,494	971,492	815,806	454,613,249	65,860,084
1911	880,098	984,646	877,697	465,414,048	63,251,731
1912	1,004,844	.....	956,335	469,618,000	72,500,000

Copper production figures, 1879-1891, "The Mineral Industry," Vol. I, p. 118; 1892-1911, ibid., Vol. XX, p. 166; 1912, "Engineering and Mining Journal" Annual Statistics.

Lead production figures, 1873-1880, Neumann's "Die Metalle"; 1881-1892, "The Mineral Industry," Vol. II., p. 382; 1893-1894, ibid., Vol. VI, p. 427; 1895-1897, ibid., Vol. IX, p. 431; 1898-1911, ibid., Vol. XX, p. 749. Neumann's figures are probably low, as he makes no allowance for Mexican production from 1871 to 1881, inclusive, while assigning Mexico a production of 15,000 tons in 1883. There is no allowance made for any production by Greece from 1871-1880, inclusive, although a production of 11,892 tons is assigned Greece in 1881. This figure is probably high, as in 1882 it is given at 6645 tons, and in 1883 at 9612 tons.

Zinc-production figures, 1873-1900, Ingalls "Production and Properties of Zinc;" 1901-1911, "The Mineral Industry," Vol. XX, p. 746.

The figures for gold and pig iron are taken from previous studies in the "Engineering and Mining Journal," reference to which will give the authorities.

In making up our table we have often had to choose among figures offered by several authorities. In cases of discrepancies we have adopted those which in our opinion are the most probable. Even so there are manifest inaccuracies, especially in the matter of lead production and especially in the earlier years. As time passes the methods of statistical compilation improve, omissions are made good, etc. By the end of the '80s the world's production of all of these metals was no doubt summarized in a way sufficiently accurate for the ordinary purposes of information.

Statistics of copper consumption since 1889 are available, but not for any other of these metals. It is a safe assumption that iron consumption is always about the same as the production, industrial conditions operating against the accumulation of unsold stocks of this metal to so large an extent as with some of the others. In the cases of lead and spelter also, consumption is likely to be nearer to production than in the case of copper, the most speculative of metals. We must perforce be contented with production figures and hesitate to draw from them conclusions that are too sweeping, recognizing (1) the possibility of errors, particularly in the earlier years; and (2) the accumulation of stocks at certain periods.

In the diagram, lead, zinc and copper are plotted in units of 10,000 metric tons; pig iron in millions of metric tons; and gold in ten millions of dollars.

An inspection of the graphs as plotted shows them to be of the general form of the exponential curves:

$$r_n + m = r_n^{x^m}$$

wherein r_n and $r_n + m$ are the productions in any two years, m years apart. To calculate the general equation of these curves for pig iron, which offers the longest term of years for the investigation, the effects of sudden fluctuations due to panics, etc., were minimized by computing an average production figure for the five-year periods 1851-1855; 1879-1883; 1894-1898; and 1907-1911. These figures are: 5,253,261; 19,266,131; 28,954,065; 59,929,874. The value of x as defined in the above equation was then computed for the periods between the middle years of the five-year periods.

1853-1881; $x = 1.0028839$
1853-1909; $x = 1.0026123$
1881-1895; $x = 1.0017170$
1881-1909; $x = 1.0023406$
1895-1909; $x = 1.0029665$

which is a fair agreement.

Calculating similar figures for the other metals gives the following results:

Metal	Period	Exponent
Copper	1879–1881 to 1910–1912	1.0044253
Lead	1883–1885 to 1909–1911	1.0023193
Zinc	1877–1879 to 1909–1911	1.0033785

For this calculation, an average of three year's production was taken in order to minimize the effect of statistical inaccuracy, financial conditions, in the same way that average figures were taken for iron.

From these figures, and the one previously calculated for iron, can be seen the relative rapidity of increase.

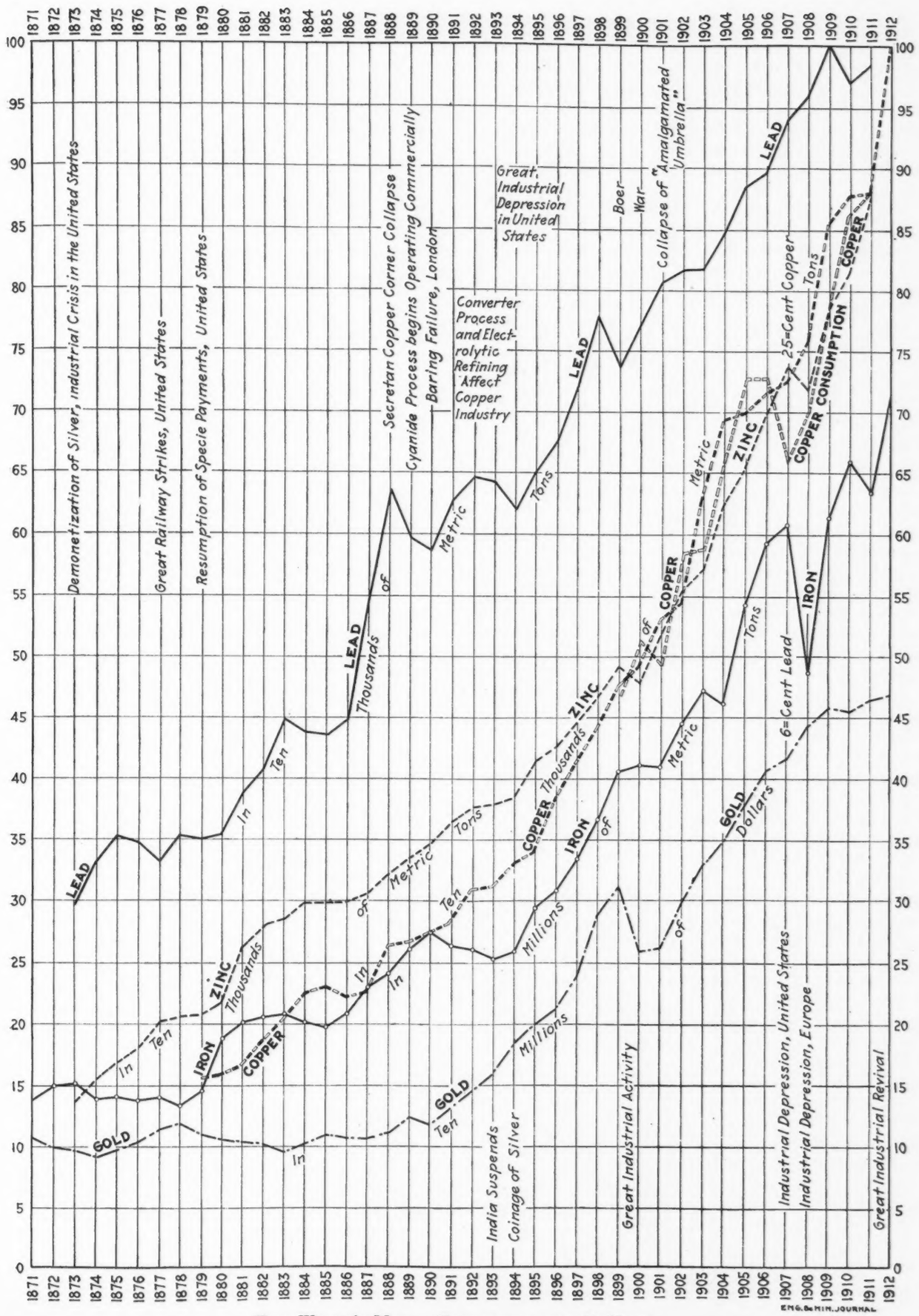
If we take the above figure for copper and calculate from the 1879-1881 figure back to an assumed production for 1851, according to the equation $x^{1.0044253^{28}} = 158{,}928$, we get for the 1851 production 37,676 tons.

PROBABLE WORLD'S PRODUCTION OF METALS

	1915 Metric Tons	1920 Metric Tons
Copper	1,176,100	1,606,700
Iron	77,182,000	95,557,000
Lead	1,155,800	1,359,300
Zinc	1,074,800	1,317,400

As the production for that year is usually estimated at about 49,700 tons, we can see that the rate of increase of production has increased greatly for copper since the inception of the electrical industry.

As a forecast, if the above rate of increase of production holds, the figures in the table above may be expected in 1915 and 1920.



THE WORLD'S METAL PRODUCTION FOR 40 YEARS

Doctor Douglas expounded the theory that copper consumption maintains a certain ratio to iron consumption. That is probably true, and also it is probably true that lead and zinc consumption do the same thing. However, no doubt many conclusions may be drawn from the respective metal curves and the industrial history of the times they represent. The lead line is the most irregular, and indicates that if the production of any of the metals be now halting that is more likely to be the case of lead than any of the others.

Chrome, Coal and Pyrite in California

SPECIAL CORRESPONDENCE

An advance chapter from the 1912 general report of the state mineralogist of California contains a brief record of production of chrome, coal and pyrite in the year. The production of chrome, or chromic iron, in 1912 amounted to 1220 tons, valued at $10,310, as compared with 935 tons, valued at $14,197, in 1911. The decrease in value was due to the production of an inferior grade of ore. The output came from Shasta and Siskiyou Counties. The available ore in the state largely exceeds the domestic demand. It is used principally as the refractory ingredient in reverberatory and other furnace linings.

The total coal production in 1912 was 14,848 tons, valued at $39,092, an average of $2.63 per ton, an increase in tonnage and value over 1911, the production in that year being 11,047 tons, valued at $18,297, or an average of $1.65 per ton. The increase in value was due to an improvement in the quality. The local demand was strengthened in 1912.

The total pyrite production in 1912 was 69,872 tons of crude ore valued at $203,470, or an average of $2.91 per ton at the mines. This represents increases of 15,647 tons and $20,516 over 1911. The average value per ton in 1911 was $3.37. The production was used in the manufacture of sulphuric acid. Large quantities of pyritic ores are annually mined and treated for other than the sulphur content. The entire output here mentioned for 1912 and 1911 came from Shasta and Alameda Counties.

Lignite Testing in Saskatchewan

The construction of an experimental station at Estevan, Sask., for the purpose of demonstrating the commercial possibilities of lignite coal, has been commenced by the provincial government. The work is expected to be completed in a few weeks. The tests will be made by Professor Darling. A recent exhaustive investigation, conducted by R. O. Wynn-Roberts for the Saskatchewan government, showed that lignite coal is now extensively used in many parts of the world as a fuel and power producer. The province possesses extensive lignite deposits, the contents of which were estimated in 1909 by Dr. D. B. Dowling at 18,000,000,000 tons, the total quantity in the three provinces of Saskatchewan, Alberta and Manitoba, and the eastern part of British Columbia being estimated at 78,160,000,000 tons. Should the tests prove satisfactory, New York capitalists are prepared at once to install a gigantic power plant at or near Estevan, to generate sufficient power to supply the southern half of the province.

New South Wales Mineral Production in 1912

Final figures on the 1912 mineral production of New South Wales are now furnished by the Department of Mines of that state. The total value of the output is £11,641,435, the largest in the history of the state. This record is attributed to the high prices ruling, the absence of serious labor troubles and a marked expansion in the coal trade. Gold and copper are the only metals whose production shows a decrease in value. The total number of employees is estimated at 37,858.

The gold recovery for 1912 was £702,129, a decrease of £67,224 from 1911. The Cobar field continued as the chief contributor, with the Mount Boppy the leading mine of the state. Gold dredges furnished £80,276, a decrease of £18,969 from the 1911 figures.

Tin and tin ore to a value of £338,074 were produced in the year, an increase of £30,985 over 1911. Stanniferous lodes were discovered at Ardlethan. Tin dredges were the chief source of the metal, furnishing 1621 tons valued at £223,183, a decrease of 121 tons and an increase of £15,718 on 1911 figures.

Silver, lead and zinc mining received much attention during the year. Exports were as follows: silver, silver-lead, concentrates, etc., £3,481,266; lead (pig and matte), £264,530; zinc (spelter and concentrates), £1,766,242. The total of these exports represents an increase of £1,444,510 over 1911. The Broken Hill field is the leading contributer, showing an increase in spite of a shortage of labor. A silver-lead discovery of apparent importance was made at Mineral Hill, about 42 miles north of Condobolin.

The 1912 production of copper was valued at £579,791, a decrease of £10,311 from the previous year. The Electrolytic Refining & Smelting Co. of Australia, Ltd., at its Port Kembla works made 16,888 tons of electrolytic copper, chiefly from Mount Morgan blister.

The coal production for the year was 9,885,815 tons valued at £3,660,015. Shipments amounted to 6,053,118 tons worth £3,232,729, an increase of 1,029,038 tons and £568,338 over the previous year. Coke to the extent of 241,159 tons valued at £162,454 was produced during the year, a decrease of 23,528 tons and £21,883 from 1911. Kerosene shale production was 86,018 tons worth £34,770, an increase of 10,914 tons and a decrease of £2210, from 1911 production. Bounties to the extent of £4017 on kerosene and £848 on paraffin wax were paid.

The Iron Smelting Works at Eskbank produced 32,677 tons valued at £130,708, a decrease from 1911. The Broken Hill Proprietary Co. will embark on steel and iron manufacture at Newcastle.

The value of other metal and mineral production is as follows: Alunite, £13,700; antimony, £355; bismuth, £1210; diamonds, £2001; ironstone flux, £761; lime, £44,478; limestone flux, £11,066; marble, £1340; molybdenite, £3706; precious opal, £35,008; platinum, £3880; portland cement, £368,280; scheelite, £4963; wolfram, £16,584; and sundry minerals, £8626.

The 1911 Death Rates in Metal Mines were given by George S. Rice before the New York Section of the American Institute of Mining Engineers as 4.29 per 1000 for the Transvaal, 4.19 for the United States including nonmetal mines excepting coal, 3.16 for France, 2.25 for Spain, 0.69 to 2.23 for Australia and 1.39 for Germany

Cyaniding Zambona Low-Grade Silver Ore

By Harley A. and Rush T. Sill*

SYNOPSIS—Treatment of low-grade silver ore at the Zambona mine, Sonora, Mexico. Profitable results depend on embracing every opportunity of increasing extraction and decreasing cost. The silver occurs as sulphide and chloride and is readily treated by cyanidation. Stamps are used for crushing and Hardinge mills and tube mills for fine grinding. Agitation is performed in tall, narrow Pachuca tanks. Continuous filtration is practiced. Precipitation is accomplished by the use of zinc dust in a feeding mechanism of special design. Recovery percentages are carefully calculated and checked for accuracy.

❖

It is well known that great profits are being obtained from low-grade gold ores, when treated in enormous tonnages, as at the Homestake and the Alaska Treadwell mines. That low-grade ores can be treated at a profit, even when worked in quantities of only 150 tons per day, has been proved at the Zambona mill, in Minas Nuevas, Sonora, Mexico. This has been accomplished by taking advantage of local conditions and materials, and by devising special means to increase the efficiency of the plant, such as the determining of the relative grinding efficiency of native quartz and imported pebbles in the tube mill and the substitution of the former for the latter. Also by careful testing of each step in the process for an increased extraction at diminished cost. Each of these elements has contributed to the successful milling of the low-grade silver ores of the Zambona mine.

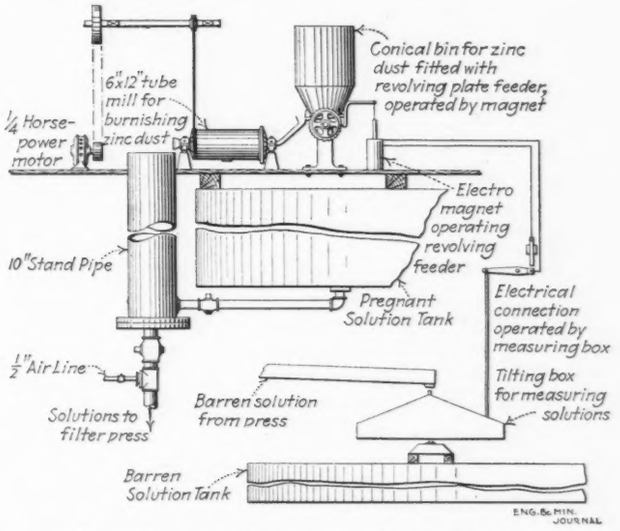
Silver Occurs as Chloride and Sulphide

The ore is a brecciated porphyry, with the lines of fracture filled with calcite. An analysis of it shows the percentages of the elements contained: Silica, 62.51%; insoluble, 1.60; aluminum oxide, 11.39; iron oxide, 5.68; calcium oxide, 6.22; copper, 0.33; zinc, 0.58; carbon dioxide, 2.54; potassium oxide, 6.56; sodium oxide, 1.41; magnesium oxide, 0.64; sulphur trioxide, 0.02%. Of the silver, 60% occurs in argentite and 40% in chlorides. The chlorides are readily dissolved in cyanide but the sulphides require longer treatment in stronger solutions.

The ore containing from 3% to 5% moisture, coming from the mine, is dumped on to a grizzly, screening to 1 in. The oversize goes to an 8x10-in. Blake crusher where it is broken to a maximum size of 1 in., from which it drops into two bins of 125 tons combined capacity, each bin serving two batteries. Four Challenge ore feeders, driven from the center stamp of each mortar, feed the ore from these bins to 20 stamps of 1050 lb. each. The stamps, dropping in the order of 1-3-5-2-4, with a 7-in. drop and 112 strokes per minute, crush in cyanide solution of 1.3 lb. to 1.8 lb., reducing the ore to 12 mesh. Of the product from the stamps 85% is held on 100 mesh, 5% on 200 mesh and 10% passes through a 200-mesh screen.

The pulp is then carried by the launders to a 5-ft. settling cone, with a peripheral overflow, where the first stage of classification begins. The overflow from the cone, containing only about 8% of solid, goes to two Dorr classifiers, while the sand enters an 8-ft. Hardinge conical mill, which serves as an intermediate grinder and reduces 43% of the product to pass 200 mesh with 10% remaining on 100 mesh and 57% on a 200-mesh screen. This mill, requiring 38 hp. when running, makes 26 r.p.m. and has a capacity of about 70 tons per 24 hr. It is lined with 5-in. silex blocks, which on this ore have a life of approximately six months. The discharge from the Hardinge mill is elevated by air lift to a Dorr classifier.

The slime from this classifier passes to two 16-ft. Dorr thickeners and the sand is discharged into a 4½x16-ft. Allis-Chalmers tube mill, together with sufficient tailing from a former concentration process to make the duty of the mill 60 tons per day. A second Allis-Chalmers tube mill, of the same dimensions, handles an approximately equal tonnage of tailing from the dump. These mills


Conical bin for zinc dust fitted with revolving plate feeder, operated by magnet
6"x12" tube mill for burnishing zinc dust
¼ Horse-power motor
Electro magnet operating revolving feeder
10" Stand Pipe
Pregnant Solution Tank
Electrical connection operated by measuring box
½" Air Line
Tilting box for measuring solutions
Barren solution from press
Solutions to filter press
Barren Solution Tank
ENG. & MIN. JOURNAL

Zinc-Feeding Device at Zambona Mill

serve as final fine grinders, bringing the pulp to a degree of fineness such that 70% of the original ore will pass a 200-mesh screen, 20% to pass 100 mesh, but held on 200 mesh, and 10% remaining held on 100 mesh.

Native Quartz Pebbles Reduce Expense

The discharge from the tube mills is elevated to the classifiers by two Frenier spiral sand pumps, thus completing an endless process of grinding and regrinding, until the pulp is sufficiently fine to yield easily to the action of the cyanide solutions. In the tube-mill crushing, it is found more economical to use native quartz at a cost of $2 per ton instead of imported pebbles at $65 per ton at the mine, since the difference in the quantity of pebbles used is only 45%. Thus the difference in pebble cost is about as 1:16 in favor of native quartz, with only a fraction of 1% difference in the grinding efficiency. Approximately 660 lb. of imported pebbles were added to each mill every 24 hr.; while in using the native quartz, from 1000 to 1100 lb. are required. These mills each consume 37 hp. when running and are driven 28 revolutions per minute.

*Sill & Sill, mining and metallurgical engineers, Los Angeles, Calif.

The finished product is delivered to two Dorr thickeners, the first receiving the bulk of the pulp, while the second receives the overflow and lighter material. The thickened pulp is drawn off into a large stone pila, or tank, 25x20x10 ft., where it is kept in mechanical suspension until it is pumped to three 50x12-ft. Pachuca tanks for final agitation and extraction. The spec. grav. of the pulp varies from 1.11 to 1.27 at this point.

Pulp Agitated in Pachuca Tanks

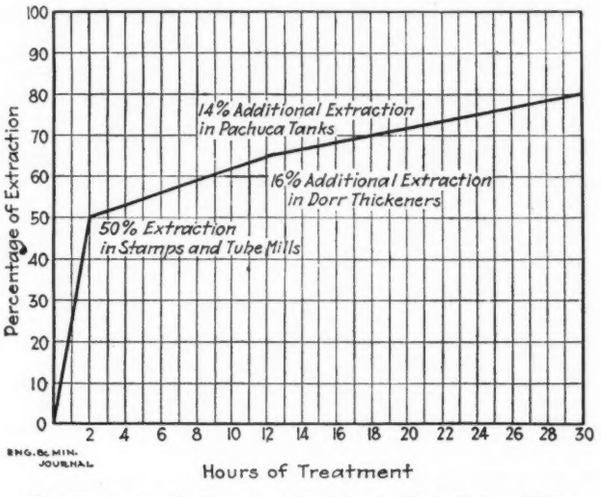
The clear solution from the Dorr thickeners is decanted and pumped to two tanks, just above the batteries, where it, together with the barren solution from the precipitation press, becomes the working solution used for crushing in the batteries. This solution varies in strength from 1.5 to 1.8 lb., according to the amount of barren solution added. The solution is restandardized and brought to a strength of 2 lb. before it enters the tube mills for further use in crushing. As the product is discharged from the tube mills, the solutions contain 50% of the value of the ore, as shown in Fig. 1. As the working solution continues through the process to the pila, or pulp storage tank, it increases the percentage of extraction 16%. The pulp from the pila is then raised, by centrifugal pumps, to three Pachuca tanks 50 ft. high and 12 ft. in diameter, where it is kept in agitation by a 45-lb. air pressure for 18 hr., which is found to be the time required for the best possible commercial extraction. The agitation in the Pachuca tanks increases the percentage of saving from 13% to 14%, thus making the total extraction on the ore from 79% to 80 per cent.

A Special Feeder for Zinc Dust

The treatment for extraction now having been finished, the ore passes to two Oliver filters where a 20-in. vacuum dries the cake, until it contains but 22% moisture. It is then automatically discharged on a conveyor belt and carried to the tailing pile. The solution from the filters is discharged from the vacuum pump into a receiver, from which it is pumped to a series of clarifying tanks. The solution having settled is admitted into a 10-in. standpipe beside the clarifying tanks, over which is placed a 6x12-in. tube mill, through which the zinc dust is fed automatically into the standpipe by means of a magnet connected with the tripping bucket at the zinc press in the precipitation room below. As the bucket is filled with the discharge from the press, an electrical connection is made with the magnet at the zinc mill, and it in turn operates the automatic feeder which lets the required amount of zinc dust enter the mill, where it is mixed, burnished and discharged into the standpipe. This arrangement is shown on p. 745. The amount of zinc required is easily determined by testing the barren solution flowing from the press, with a saturated solution of sodium sulphide. The addition of a few drops of sodium sulphide to a small quantity of the solution from the press determines quite accurately, in the case of silver ores, whether an excess of zinc is being added or more required. A milky white precipitate following the addition of the sodium sulphide is a precipitate of zinc sulphide, indicating an excess of zinc. A brown precipitate indicates the presence of silver sulphide and shows an insufficient amount of zinc to precipitate all of the silver from the solution. However, as an excess of the zinc decreases the fineness of the precipitate and increases the cost and length of time required in refining, it has been found advantageous to allow the barren solution leaving the press to show a slightly brown color, indicating the presence of a small amount of unprecipitated silver in the solution. It is well to leave from 0.1 to 0.2 oz. of silver in the barren solution. This does not entail a loss, as the discharged solution enters a stone pila or tank, from which it is raised by a triplex pump to another large stone tank above the mill where it becomes a part of the working solution for the batteries.

Cleanup Twice Each Month

The precipitate is removed from the press twice a month for refining. Before opening the press a current of air is blown through it for a few minutes to remove the solution and dry the cake. The product is then scraped from the leaves into shallow iron pans placed underneath the press. The leaves are covered with two sets



Dissolving Rate of Silver at Zambona Mill

of cloths, the outer of which is removed and burned at each cleanup. The inner set then takes the place of the outer one and a new set is placed next to the filter leaves. The precipitate is dried over a slow fire until the moisture content is reduced to 7%. It is then sampled by screening through a ¼-in. screen, coning and quartering until the sample is reduced to two pounds. This sample is thoroughly dried, mixed and quartered and a one-tenth assay ton charge is removed for assaying, the assays being made by scorification and run in triplicate. The precipitate is now fluxed and smelted in a tilting fusion furnace, using crude oil for fuel. The average metal content of the precipitate smelted is 75% and the resulting bullion bars are about 900 fine or more. The entire process of refining is accomplished with a loss approximating 1½ per cent.

Recovery Is Carefully Calculated and Checked

By a systematic checking of the crude ore and refined product, we determined our actual saving and loss. Ten cars of ore are weighed each day and their moisture taken and the average weight thus secured is used as a standard for the tonnage milled. Two samples, a day and a night sample, are taken from each battery. The weight of the ore is again checked after it has entered the

Pachuca tanks by careful measurement and computation of the specific gravity of the pulp. Day and night samples are taken at frequent intervals from the tailings of each filter as they discharge onto the conveyor belt running to the tailing pile. Thus the content of the ore and tailing is accurately determined. The ore content is checked against the refined product by taking a drip sample of the pregnant solution before, and the barren solution after, precipitation. A checking of the ore and solution content with the silver bars, proves the bullion and completes the process of an interesting and well regulated cyanide plant.

The cost of milling amounts to about $1.78 per ton treated, a low figure under the circumstances, but one necessary to reach by reason of the extremely low silver content of the ore.

California Oil in February

SPECIAL CORRESPONDENCE

The net production of petroleum in all California fields in February was 6,792,398 bbl., a decrease from January in total production of 347,318, but an increase of 12,278 in daily average. The shipments in February were 6,426,080 bbl., the losses 90,959, making a total outgo of 6,517,039 bbl. and leaving a surplus of 275,359, which added to the January stocks make a total of 47,883,519 bbl. on hand at the end of February. Gains in daily average production occurred in most fields, and no field declined. The Midway field increased to a daily average of 77,520 and the Coalinga to 50,384 bbl. The field record of operation and development shows 47 new rigs, 53 completed wells, 5862 producing wells active, 941 wells capable of producing but idle, 361 wells actively drilling, 362 wells on which drilling was suspended, 32 wells deepened and 10 wells abandoned. There were one gas and 22 water wells recorded. The production by districts is given in the table.

FEBRUARY PRODUCTION OF CALIFORNIA OIL BY DISTRICTS

Districts	Bbl.
Fresno County—	
Coalinga	2,410,750
Kern County—	
Midway	2,170,558
Kern River	748,866
Maricopa	390,292
McKittrick	336,995
Belridge-Lost Hills	325,643
Total Kern County	3,972,354
Santa Barbara County—	
Santa Maria, Lompoc, Cat Cañon	347,583
Summerland	4,000
Total Santa Barbara County	351,583
Southern Fields—	
Olinda-Brea-Puente	491,738
Coyote-La Habra	217,848
Salt Lake-Sherman	191,077
Ventura	65,140
Whittier	54,896
Los Angeles	28,500
Newhall	8,512
Total southern fields	1,057,711
Total all fields	6,792,398

A Man-Power, according to the "Scientific American, is about 2.5 kw.hr. per day, i.e. an average man dissipates about that energy. This is spent partly in muscular action, partly in the production of heat in the maintenance of the body temperature against radiation. There is thus a continual power consumption of about 100 watts, or one-seventh of a horsepower. About one half of this is spent in maintaining the body temperature. The human body has about the same heating effect upon the surroundings as a 16-cp. carbon filament lamp.

Matte Smelting at Mackay, Idaho

BY F. N. FLYNN*

The White Knob smeltery, at Mackay, Idaho, consisted of two blast furnaces, designed for smelting to black copper. The lower jacket was straight for the first 2 ft. 8 in. and the remaining 3 ft. 10 in. was boshed. The upper jacket was set vertical. The size at and above the tuyeres was 44x160 in., while at the top of the lower jacket it was 70x186 in. The end jackets were boshed. The feed floor was 20 ft. above the tuyeres. The ore was crushed, mechanically sampled and elevated into six small storage bins.

Later the same plant was used for matting. The high-pressure blowing engine was replaced with a rotary blower, and a forehearth 4x16 ft. replaced the smaller one. Pyrite from Bingham Cañon, Utah, supplied the sulphur for matting, and the matte was sold to Utah smelters.

MATTE SMELTING WITH MAGNETITE FLUX

The mine ore contained 0.25% sulphur and 3.25% copper. The gangue was garnet. Some ores contained magnetite, and one stope carried a little zinc. Occasionally a small quantity of impure limerock was used, but magnetite was the usual flux. The following analyses are representative:

Material		Cu	S	SiO_2	Al_2O_3	Fe	CaO
Garnet ore	High	5	6	39	9	20	23
	Low	2	0	30	6	14	14
Magnetite flux		1	0	12	7	50	8
Limerock		..	..	..	..	..	38
Pyrite		1	38	21	1	35	..
Matte		42	22	..	..	29	..
Slag	High	0.45	0.3	42	8	28	25
	Low	0.30	0.2	37	6	18	14

The ore was purchased by the smeltery from six groups of lessees at the mines.

When I took charge of the furnaces in 1907, the practice was to smelt 2500-lb. charges, with 15% of high-ash coke, with a five-foot ore column. The high coke was attributed to the shape of the jackets, which formed a shelf on which the crusts accumulated. It was a well established fact that the furnace would freeze within 24 hours on a 7-ft. ore column. The mixture of all classes of ore smelted nicely with the low column.

The consumption of pyrite was largely in excess of the matte requirements, the reason being that when the charge was dumped into the deep shaft, the coarse material crossed the shaft and rebounded to various parts of the furnace and the fine pyrite did not spread. Layer feeding was impossible under the conditions.

Within a few days after my arrival, fire destroyed the crushing, sampling and storage plant and when the furnace was cleaned, an iron "sow," which contained 81.6% Fe, was found over the entire bottom of the crucible.

There were no funds for rebuilding the burned plant. All ores and fluxes were in large lumps, 12 to 18 in. was common. It was decided to smelt the uncrushed and unsampled material from each lessee separately, with such flux as was necessary, and keep the matte shipments separate, which meant a month's run on each. Heretofore the separate ores had never been smelted alone for more than a few hours.

It was necessary to increase the depth of the ore column, to accommodate the coarse ore, economize on pyrite and to improve the distribution of the charge. A few

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feet below the feed floor a distributor was placed in the center of the furnace, so that a charge dumped from either side would strike it and fall vertically downward. A door was cut into one end of the brick shaft half way between the tuyeres and charge floor. A platform around this door allowed the feeder to supervise the distribution of the charge. To test the new distributor, the furnace was blown in on a mixture of ore and ashes from the crushing-plant ash pile. The ore column was built up to 10 ft. before the full blast was turned on, and two weeks later all rubbish had been smelted with satisfactory results.

The first ore to be smelted for the lessee contained more silica and iron and less lime and copper than the average mine mixture. This required more magnetite and less pyrite to flux it. An effort was made to sledge the largest lumps of magnetite, but this was soon abandoned as impracticable.

Muscular Metallurgy

Within a few days a "sow" covered the bottom of the furnace to within a few inches of the tuyeres. Occasionally a lump would form, up to or above the tuyere level, forming a dam across the furnace, preventing the matte from discharging and also causing the tuyeres to slag. At times as much slag and matte would flow through the tuyeres as through the slag spout, but aside from a few frozen tuyeres and a dirty furnace floor, no damage was done. The tonnage remained fairly constant at 325 tons of charge, regardless of the sow, which did not seem to increase in size. The magnetic oxide formed was mechanically washed out of the furnace by the matte. If a sudden rush of matte and "mush" (as the oxide was called) came, it forced the furnace man to rod the "connection" vigorously to keep it open and prevent slagging tuyeres. The "connection" was 4x5 in., and would soon close up with "mush." It was impossible to bar off the crust without draining the furnace, and to overcome this the furnace man had to use various size bars, to keep the hole large enough to allow the furnace to discharge its products.

The greatest trouble was caused by inability to tap matte in the usual way. The appearance of the matte was puzzling at first. It gave off quantities of iron sparks resembling low-grade iron matte from pyritic furnaces, yet it was of normal (42%) grade. A scum floating on top of the pans analyzed: Zn, 1.1%; Cu, 4.4; Fe, 43.2%. This "mush" accumulated on the end of the matte tapping bar. To prevent the tap hole from freezing it was necessary to tap the bar with a hammer at least once in every five minutes. The farther the bar entered the forehearth, the more "mush" it accumulated and the harder it was to withdraw.

Within a few days it became the regular practice to cut off the bar with a hacksaw and drive the stub into the forehearth every time matte was tapped, which was two and sometimes three times during a shift.

It was not considered advisable to reduce the coke, but the blast was changed in volume without any marked result. To reduce the pressure would require lowering the ore column and using a larger quantity of expensive pyrite which was prohibitive, and it was impossible to secure limerock in the middle of winter. The furnace refused to make high-grade matte for more than a few hours.

The furnace had been running on this charge about three weeks, when a sudden rush of matte and mush choked the furnace connection. There was too much mush to rod effectively, and the furnace and forehearth were drained. The core of mush filling the connection gave Cu, 22.1%; Fe, 64.3%. Many tons of mush from the furnace and forehearth gave Cu, 22.9%; Fe, 60%. When the forehearth was cleaned, dozens of stubs of drills were found embedded in the mush, which effectively protected the steel from the matte.

Effects of Reduced Coke

The furnace was blown in again on the same charge. The same trouble again made its appearance, but before it became serious the coke was cut from the usual practice of 15% down to 12%. At the same time the volume of blast was reduced. The tonnage dropped from 325 to 275. The slag temperature dropped. The matte lost its sparks and some of its temperature. The tuyeres showed no change. The production of magnetic oxide had ceased. At times the tonnage fell as low as 250, but the trouble was at an end. Thereafter whenever an ore required a large quantity of magnetite the volume of blast and the percentage of coke were kept at the minimum.

The 10-ft. ore column consumed one-third less pyrite than did the lower column, when based on the copper contents of charge. The iron oxide from roasted pyrite assisted in fluxing the lower column charge, whereas with the higher column, magnetite did practically all of the fluxing. Coarse lumps of hard magnetite were substituted for fine calcines, which contained Fe_2O_3. The difference was so marked, that had the facilities been at hand, the magnetite would have been crushed to half an inch.

Driving the furnace for tonnage did not allow sufficient time for preparing the lump magnetite for its reduction. The reason for cutting the coke and volume of air was not due to any theory regarding the chemical reaction of carbon or oxygen on the magnetite, but solely to give it the time required for reactions to take place. The bulk of the iron on the charge existed as silicate of iron formed when the lime was garnetized, its presence could therefore be ignored when considering oxidation.

Allouez Mining Co.

The report of the directors of the Allouez Mining Co., of Michigan, for the year ended Dec. 31, 1912, shows a gross production of fine copper of 5,525,455 lb., sold at an average price of 16.668c. From silver sales and miscellaneous receipts, the income was $16,768, making a total income of $918,435. The running expenses at the mine amounted to $538,169, and smelting, freight, commissions, Eastern office, etc., $103,470. Construction at the mines amounted to $88,184; a total of $729,824 for expenses. Profits from operations for the year were $188,611, balance of interest paid, $17,346 and net profits for the year, $171,264.

In No. 2 shaft the drifts north and south have opened up grounds up to the average of the previous year. The shaft, sinking partly in the lode and partly in the footwall, showed poor ground during the first half of the year, but during the last half of the year a fair grade of rock was exposed. The equipment for this shaft, mentioned in last year's report, went into commission during the summer.

Total assets are given at $552,655, and total liabilities at $459,091; balance of assets over liabilities, $93,564.

Rate of Dissolution of Free Gold in Cyanide Solution

By John Gross*

In some testing work recently done it was found desirable to investigate the dissolving power of cyanide solutions on free gold, some of which was fairly coarse. The treatment time possible to give to the sand leaching was seven days.

In portions of the mine coarse free gold was encountered that would cause more or less loss in tails in the plant if a satisfactory extraction could not be obtained on this material. A sample of ore was taken from one of the workings where free gold was known to exist. This was carefully panned and the gold washed free from the rest of the ore; the free gold consisted of particles varying in size from the very finest to a piece about $\frac{1}{16}$-in. across. The gold was known to consist of, approximately, 60% gold and 40% silver.

The treatment outlined called for a solution strength in the plant of 4 lb. KCN per ton, and this strength of solution was used in the experiment. The free gold was placed in a small beaker and agitated with 25 c.c. of solution; at regular intervals the solution was removed and the gold contents determined by assay, a fresh solution of equal quantity and strength again being agitated with the gold. At the completion of the experiment the residue, which consisted of particles of all sizes, was assayed and the gold determined, this, together with the total gold dissolved, giving the gold content of the original material.

RATE OF DISSOLVING FREE GOLD IN CYANIDE SOLUTION

Treatment time Days	Gold Dissolved Daily Mg.	%	Total Gold Dissolved Mg.	%
1	2.23	4.67	2.23	4.67
2	3.45	7.23	5.68	11.90
3	3.80	7.96	9.48	19.86
4	3.55	7.44	13.03	27.30
5	3.69	7.72	16.72	35.02
6	3.33	6.96	20.05	41.98
7	2.50	5.25	22.55	47.23
8	2.21	4.62	24.76	51.85
9	2.37	4.99	27.13	56.84
10	2.38	5.00	29.51	61.84
11	2.14	4.48	31.65	66.32
12	1.65	3.45	33.30	69.77
13	1.31	2.74	34.61	72.51
14	1.16	2.43	35.77	74.94
15	1.20	2.51	36.97	77.45
16	0.99	2.08	37.96	79.53
17	0.84	1.76	38.80	81.29
18	0.75	1.57	39.55	82.86
19	0.61	1.28	40.16	84.14
20	0.52	1.09	40.68	85.23

Gold in residue, 7.06 mg.; gold dissolved, 40.68; total gold in sample, 47.74 mg.

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The results of this experiment, which was carried much beyond the economic point in the mill, are given in the accompanying table. It will be seen that the maximum daily extraction was obtained after three days and at the end of 20 days an appreciable amount of gold was still going into solution.

Based on the results of this experiment, together with other data to verify it, the plant was equipped with blankets placed after the stamps (amalgamation not being desirable owing to crushing in a cyanide solution)[1], the production from this source amounting to 27% of the gold and 3% of the silver produced in the entire plant.

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Petroleum Explorations in Colombia

Special Correspondence

Considerable activity has been shown of late in the development of an area, supposed to be petroleum bearing, on the north or Caribbean coast of Colombia. Near Turbaco, a small town on the railway, 16 miles east of Cartagena, the Cartagena Oil Refining Co. is drilling the third well which has been put down on its property. The well is situated in a valley about 350 ft. above sea level and on both sides coral ridges rise to an elevation of 450 or 500 ft. On these ridges are mud volcanoes, one particular chain of them extending for about 10 miles. They emit muddy fresh water at a temperature of about 70° F., along with an odorless gas, called by the manager of the operations, marsh gas. The two previous wells were drilled in the immediate vicinity of the mud volcanoes, but failed to find anything except small amounts of gas.

Cartagena Oil Refining Co.'s Rig Drilling Near Northern Coast of Colombia

Work was commenced on the third hole on Jan. 25, 1912, and the available record, up to Feb. 22, 1913, is fairly characteristic for Colombia in regions easily accessible and with good transportation facilities. The property is about three miles from the railroad and in the dry season the connecting road is good. The drilling rig is of the California type, driven by a 23-hp. engine supplied with steam by wood-fired boilers. The wood for fuel is mainly the undergrowth cut in the immediate vicinity and brought in on burros. Boiler water is pumped from a small reservoir about half a mile distant. The various sizes of casing used are: 12-in. to 251 ft.; then 10-in. to 777 ft.; 8-in. to 1543 ft.; 6-in. to 1920 ft.; 4½-in. casing is still in use at 2170 feet.

[1]The successful results obtained at the Liberty Bell mill, Telluride, Colo., where crushing in cyanide solution, followed by amalgamation, is practiced, would seem to show that the procedure may have advantages.—Ed.

The formation, from the beginning, has been a black carbonaceous mud, or as it is locally called, shale, having little evidence of stratification. Much clay was mixed with the mud at the beginning, but with depth, sand is increasing. A gas, described as "marsh gas," was found in small quantities at 700 ft.; at 1800 ft. a volume of gas was encountered that was thought to be suitable for the manufacture of gasoline. At 2125 ft., a bed of sand yielded gas and small amounts of oil with presumably an asphaltic base. The management believes that thus far the hole has been in the mud of the old Magdalena River delta, and that below this an oil-bearing sand will be found.

The well is practically dry, outside water being introduced for drilling purposes. At times, during a short suspension of operations, the shale, as it is called, has been known to raise 70 ft. in the casing and to pack so hard that it was necessary to drill it out. Under favorable conditions, the average advance per day of 24 hr. is 10 or 12 ft. No work is done on Sunday. The equipment from the previous holes was not available for this present work, making necessary the purchase of a new drilling outfit, construction of houses, the purchase of the necessary livestock, etc. The drill rig cost $8000 at the site of the well, but not set up; aside from the drill, the total cost of operations and equipment from Jan. 25, 1912, to Feb. 22, 1913, has been approximately $30,000 and the footage drilled 2170 ft. The above cost includes the salary of the American manager, M. Wanner, and two American drillmen. During the time in question, the drill has been idle approximately four months, due to lack of supplies and breakage.

The most extensive petroleum drilling in Colombia has been done by the Colombia Oil & Gas Co., of Canada. The home office of this company is at Ottawa and the Colombia office at Baranquilla. Six or seven holes have been drilled on the company's lands, at Turbaraj, near Savinilla. One well became a fair temporary producer, though now it is yielding but a fraction of its former output. The oil is pronounced to be of a good grade, having a paraffin base. In February, 1913, this company had one well down to a depth of 2750 ft., which is reported, for practically the entire distance, to have been in a black shale streaked with beds of sand.

At Lorica, on the Sinu River, a German company has been prospecting for petroleum with drills operated by hand power; these proved unsatisfactory, however, and operations have been suspended pending the arrival of steam-driven machinery. The drilling done thus far in Colombia is merely exploratory, and taken as a whole, the results cannot be regarded as extremely encouraging.

Prat System of Boiler Draft

The use of suction fans to create a draft is common in boiler practice. It labors under the disadvantage of having to handle the entire output of the furnace. To cut down the cost, the size of the fan is usually restricted, which greatly increases the resistance and loses the benefit of natural draft.

In the Prat system only a part of the products of combustion are passed through the fan, or none at all, according to a pamphlet by Louis Prat, of Paris (abst. *Power,* Mar. 18, 1913), and the fan acts rather as an accelerator of the natural draft. Either burnt gases from the boiler or fresh air from outside are given a high speed in the fan and pass out through a vertical nozzle in the chimney, thus acting on the familiar ejector principle. If cold air is used, the temperature of the gases is lowered and an additional bulk of material has to be handled, but if part of the furnace gases are passed through the fan, it runs in heated gases, which is somewhat of a disadvantage. With the ordinary suction-fan system, in order to provide against breakdowns, two units must be supplied at rather great expense. In the Prat system, the emergency provision is an auxiliary steam jet set similarly to the nozzle from the fan and available for use in case of a breakdown on the fan or for increasing the capacity when desired.

The Prat system, although used extensively abroad, is practically unknown in this country. However, a similar system is now being put forward by an American firm, the Schütte & Koerting Co., of Philadelphia.

The Fuerte District, Sinaloa

By G. L. Sheldon*

The Fuerte mining district is in the northern part of the state of Sinaloa, Mexico, and is bordered on the north by the state of Sonora. It is accessible by the Kansas City, Mexico & Orient Ry., which connects Fuerte, the principal town of the region with San Blas, 38 km. distant, on the Southern Pacific R.R. of Mexico. The town of Fuerte has a population of 5000 and is in an agricultural region. The principal mining regions are to the east and north of the town, but copper veins in porphyry are known to the west and down the Fuerte River, below the town.

Gold, Silver, Copper and Lead Found

The Porvenir mine has been worked to a depth of 200 ft. on a vein 3 ft. wide, that averages 1 oz. gold per ton and is owned by Kansas City men. Owing to dissension among the owners, the property has been idle for several years. Formerly the natives took $70,000 from a surface pocket. There are placer deposits in a nearby arroyo, below.

Over the state line in Sonora are the Sabina Cuata mines. The Rosario mine, situated at corner of three states, Sonora, Sinaloa and Chihuahua, is owned by the Egyptian-Paris Bank, of France. The vein is in limestone and consists of lead-carbonate ore containing silver. It had a large production 50 years ago. There are other veins in this vicinity in which silver, copper and gold occur. To the east of the Fuerte River and two miles from the Lluvia de Oro mine, the veins contain lead as well, that also being the principal metal in the veins at Molinos.

Little Development Work Done

The Choix company owns a vein of copper ore that crosses the arroyo Reforma at Reforma, but little work has been done upon it. A few miles above La Junta at the junction of the rivers Fuerte and Chinipas, there is a vein of gold-silver ore that is reported to average $5 per ton in gold and silver. The town of Choix is 42 miles from Fuerte by wagon road, and is the real business center of the district. The house of Vegas carries one of the best stocks of American goods, mining and comis-

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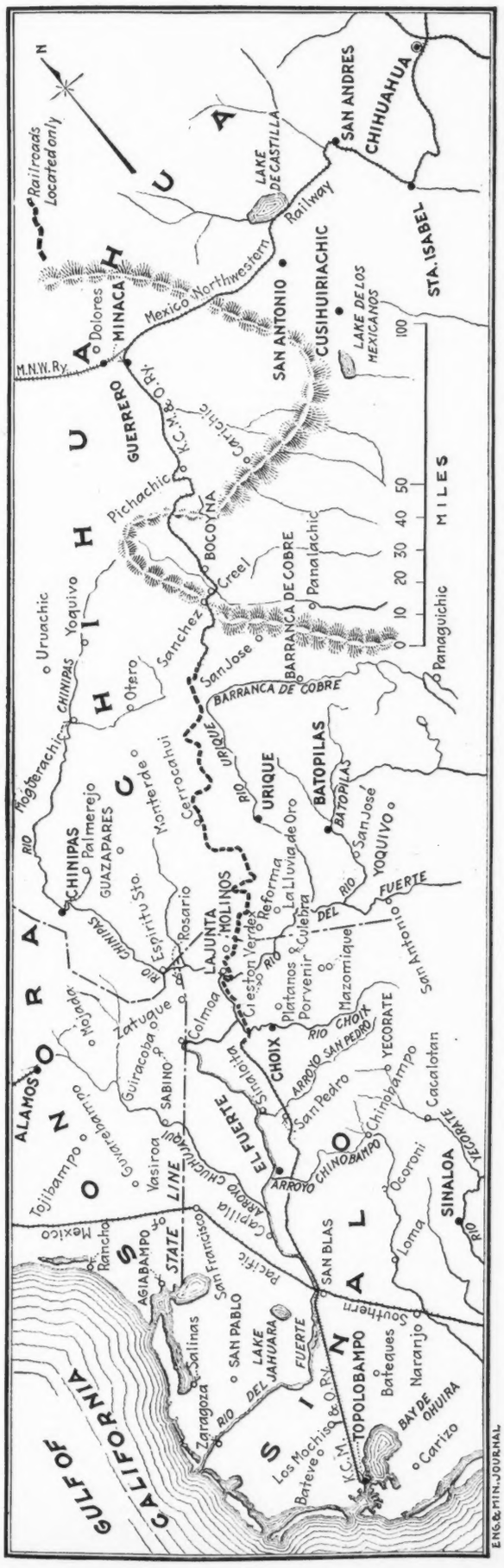

A Portion of Sinaloa, Sonora and Chihuahua, Showing Mining Districts and Railroad Connections

sary, to be found on the West Coast. The Platanos mine, seven miles to the east, was worked a few years ago and $100,000 worth of ore was shipped; it contained about 20% copper and practically no gold nor silver. The ore was transported to the port of Agiabampo, a distance of 100 miles, by mules, burros and wagon, at a cost of 15 pesos per ton. Two unsuccessful attempts have since been made to put the mine on a paying basis. Southeast of Platanos is the Mazomique copper mine, a large deposit of 2% ore. To the east 12 miles, near Medriles, there are a number of small gash veins from which gold has been taken and some of which contain silver and copper as well as gold. Attempts were made to work veins of zinc ore, but these failed to prove profitable. In this section there is a recent discovery of a 150-ft. vein, said to run $8 gold per ton.

Three miles north of the town of Las Papas is the El Oro property, attempts to work which have been made continuously for 10 years, but to no profit. Three miles farther north is the Los Cueros mine, which was worked 40 or 50 years ago for silver which occurs native in the vein. Within the last few months an American working it has found rich native silver ores.

North of Choix there are many copper prospects, among which is the Creston Verde, but from all of these only a small quantity of ore has been produced and shipped. The ore contains gold, silver and copper. Molybdenum ore has also been found in this region. Twenty miles up the Choix River from Choix a new discovery of copper has been made from which several cars of 20% copper have been shipped carrying high silver.

Placer Deposits Overlying Metamorphosed Coal.

East of Fuerte is a region of slates and shales in which small gold veins occur, the erosion of which has produced small placers that are profitably worked on a small scale by natives, who use crude devices in the nature of dry placer machines to catch the gold. On the Yecorate River gold placers occur, overlying a metamorphosed coal or natural deposit of coke. At Yecorate there is a gold section three or four miles across, with some very promising prospects, veins being from 1 ft. to 20 ft. wide. And 20 miles south is a 20-ft. zinc vein with several hundred feet of development.

There are many other deposits of ore known in the Fuerte district that hold out promise of proving profitable. The district is a large one, but few of the veins are being developed. The proximity of railroads and favorable shipping conditions should, with the advent of capital, make many of the veins capable of profitable exploitation. The mines being nearly all in the prospect stage, the disturbed political conditions of the last two years have retarded development.

Gold Mining in Malay States

The production of gold from the Federated Malay States in 1910 was about $326,000 forming a little over ½% of the total exports and thus being greatly inferior to tin mining as a native industry. The principal production was from Pahang, which furnished 15,868 oz. Perak came second with about 1000 oz. Nigri Sembilan produced no gold in 1910. The principal mine, according to *Special Agent Series* No. 59, of the Department of Commerce and Labor, is the Raub in the

state of Pahang. This property has three shafts, one of which has attained a depth of 700 ft. The underground labor is all Chinese, operated on a contract system. The water is handled with a Cornish pump. The hoisted ore is stamped, amalgamated and concentrated. A cyaniding plant, formerly installed, has been abandoned. Power to the extent of 500 hp. is supplied from a hydro-electric station six miles distant and 100 hp. is obtained from a steam plant on the ground. Air drills are used to some extent but compressor capacity is lacking. In 1910 this mine had an output of 55,000 tons averaging 0.264 oz. per ton.

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Secondary Silver Enrichment

Some laboratory experiments made on silver and its minerals with the object of throwing light on the subject of secondary enrichment in silver deposits, are described by H. C. Cooke (*Journ. of Geol.*, Vol. XXI, No. 1). Information on the following points was sought: (1) Solvent effect of sulphuric acid and ferric sulphate on argentite and its associated sulphides, both natural and chemically pure artificial minerals being used; (2) the solvent effect exerted on metallic silver by the various reagents that may occur in ground-waters, such as sulphates, chlorides, nascent chlorine, sulphuric and hydrochloric acids; (3) solvent effect of ferric-sulphate solutions on silver chloride; (4) effect of the presence of ferric sulphate on the solubility of silver sulphate; (5) the equilibrium in dilute solutions between ferric, ferrous, and silver sulphates and native silver; (6) the substitution of silver for antimony or arsenic in the previously formed sulphides of these elements; (7) the reaction of metallic silver with precipitated sulphur.

The first experiments were conducted by crushing the minerals to pass 40 mesh, but in later experiments only that passed through 80 mesh and held on 100 mesh was used. The powdered minerals were treated with reagents in flasks which were left in a dark room for from one to three months and shaken almost daily. The following conclusions were deduced:

Secondary sulphide enrichment of a primary silver deposit is brought about by reactions of silver or its sulphides with the sulphides of iron and their products of oxidation.

(1) When the iron sulphide present is pyrite, the silver sulphide is converted into sulphate wholly by the sulphuric acid and the ferric sulphate produced by the oxidation of the pyrite. When marcasite is present, as it rarely is in quantity, silver sulphide may be oxidized in part directly to silver sulphate by electrolytic action, and in part may be converted into sulphate by the action of the oxidation products of the marcasite. Sulphuric acid and ferric sulphate exert a powerful solvent action both on silver sulphide and on its companion sulphides, such as galena, chalcocite, orpiment, and stibnite. Of these, silver sulphide is the least affected. In all cases the action is much more powerful when ferric sulphate is present than when sulphuric acid acts alone. Except in the case of galena, the solvent action does not seem to be proportional to the concentration of the ferric sulphate present. This suggests that the sulphuric acid is really the active agent, and that the ferric sulphate acts principally as an agent for the removal from solution of hydrogen sulphide formed during the reaction.

(2) A mixture of sulphuric acid and ferric sulphate has a powerful solvent action on metallic silver, hence, in an orebody containing much pyrite, little native silver may be expected in the gossan; and conversely, if much native silver be found in the gossan, the orebody cannot have contained much pyrite, and little secondary enrichment should be expected.

(3) Cerargyrite appears to be stable in presence of sulphuric acid and ferric sulphate.

(4) The presence of ferric sulphate in the ground-waters increases the solubility of silver sulphate in them. This is probably due to the formation of a complex ion $AgSO_4$ by the silver, when ferric sulphate is present in solution.

(5) Equilibrium in silver-bearing solutions between ferric, ferrous, and silver sulphates is such that the reduction of ferric solutions to the ferrous condition by any means will rapidly precipitate the silver in the metallic form. Precipitation of silver will not cease till all the ferric salt is reduced to the ferrous state. Hence the vertical extent of the zone of precipitation and its proximity to the surface will depend on the rapidity with which this reduction goes on. If reduction be slow, native silver may thus be formed even at considerable depths. Native silver so precipitated will be comparatively stable in the presence of earth waters. Acids will not attack it in the absence of oxygen, since the solution pressure of hydrogen is greater than that of silver. Ferric sulphate cannot attack it so long as the ground-waters contain enough silver sulphate to preserve equilibrium between the ferric and ferrous salts. Precipitated sulphur may convert it into sulphide.

(6) The action of dilute silver solutions on realgar, orpiment and stibnite results in the substitution into these minerals of some silver; but the amounts so substituted were found to be so small that it appears doubtful whether the complex sulpho-salts of silver can be formed in this way.

(7) Precipitated sulphur combines with precipitated silver at ordinary temperature and pressure to form silver sulphide. Silver sulphide is also formed by the direct reaction of hydrogen sulphide with silver-bearing solutions.

The presence of sodium chloride in ground-water does not increase the solubility of silver chloride therein, unless the amount of sodium chloride rises above 34.3 grams per liter; on the contrary, it decreases the solubility. Terming the sodium-chloride solution which contains the least amount of silver chloride the "minimum solution," then solutions which contain less sodium chloride than this minimum solution will precipitate silver chloride on taking up more sodium chloride; solutions with more sodium chloride than the minimum solution will precipitate silver chloride on dilution. Silver-chloride solutions containing sodium chloride in any concentration may form secondary silver sulphide wherever they encounter hydrogen sulphide or any other substance that yields sulphur ions even in minute quantity.

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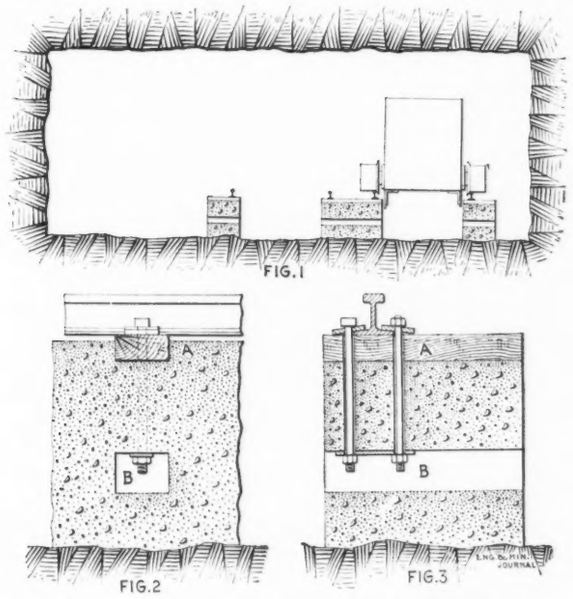
Mineral Output of Algeria and Tunis—According to the customs' statistics, as reported by "The Mining Journal," there were shipped in 1912, from the various ports, 1,047,660 tons of iron ores, 308 of copper ores, 22,683 of lead ores, 74,154 of zinc ores, and 1840 tons of antimonial ores. The Department of Constantine exported 341,520 tons of phosphates, representing a value of £423,480. The phosphate mines of Gafsa, in Tunis, shipped 1,309,819 tons during 1912, as against 1,121,000 in 1911 and 950,000 in 1910.

DETAILS OF PRACTICAL MINING

Cushion Blocks on Concrete Skiproads

By R. B. Wallace*

When concrete stringers were first used for inclined skipways, the rails were laid directly on the concrete. It was found that this introduced considerable jarring into the operation of the skips with the result that the skip repair bill began to mount. To remedy this, it was found necessary to introduce a cushion between the rails and the concrete. A convenient method of doing this is illustrated in the accompanying drawings. Fig. 1 shows the position of the skip and the stringers in the shaft. Figs. 2 and 3 show the details of the arrangement. Wooden crosspieces *A*, 2x4 in. or larger, are laid in the concrete,



Wooden Ties in Concrete Stringers

projecting slightly above it, and the rails bolted to them. An opening *B* through the stringer directly below gives access to the bolts so that the blocks are readily renewable. If the concrete is already laid, the desired cushioning can be had by introducing ¾-in. pieces of wood under the rails, where they are bolted to the concrete.

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Concreting the Junction Shaft, Arizona

The work of concreting the Junction shaft of the Superior & Pittsburgh Copper Co. in Bisbee is in progress. The particular object is the elimination of extreme fire risk at that point, according to the annual report of the company for 1912, inasmuch as the cessation of pumping through the shaft for one hour would mean the loss of all operating levels at the Junction, Briggs and Hoatson mines. Considerable preliminary work was done previous to starting concreting and the concreting itself is now well along. The finished shaft will be 27 ft. 3 in. by 6 ft. The walls are placed solid to the ground where the thickness does not exceed 30 in. Where it does exceed this figure, a dry wall is built of coarse rock and is filled in behind with mine waste, thus serving the purpose of a back form. The size of compartments was changed from 4 ft. by 4 ft. 6 in. to 4 ft. 6 in. by 6 ft. and there will be three curtain walls of reinforced concrete, two 10 in. thick, and one 8 in., which will serve as dividings; openings are left through them, 2 ft. high by 5 ft. wide, placed vertically 10 ft. apart. The concrete is mixed on the surface and dumped through vertical pipes for delivery to the point where used. In this way shoveling is eliminated.

*Mining engineer, Republic Iron Co., Republic, Mich.

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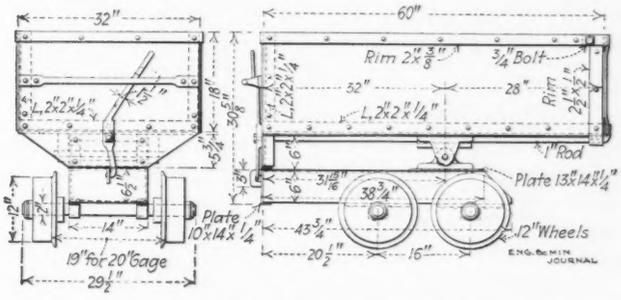
Pickands-Mather Sublevel Car

The accompanying drawing represents the standard car designed for sublevel work in the Pickands, Mather & Co. properties on the Mesabi range. The nature of the work is such that cars must be of a size to permit



Front Dumping Car Used for Sublevel Work

easy handling in narrow, crushed drifts and around sharp curves. The car shown has a capacity of 20 cu.ft., which is equivalent to about a ton of loose ore. This is an advantage in keeping a record of the work performed by various gangs. The truck is made strong to withstand rough usage and the body can be easily straightened if accidentally dropped down a chute. The tipping device is placed near the center of the car, which makes it easy to dump. The length of the car, five feet, in proportion to its wheel base, is a noteworthy feature. It is also comparatively low, for its breadth and length, which renders shoveling easier. The car will dump only toward the front. The 12-in. wheels turn on the axles. The axles are rigidly attached to the sills, which are made of channels and braced by plates over the top and on one end.

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A Power Winch for Pulling Lead Cable through the ducts is employed on the Panama Canal. For the control, power and lighting systems of the locks, 246 miles of lead covered cable, says the "Canal Record," Jan. 20, 1913, must be so pulled. To expedite the operation, a steel wire is first pulled through by the electrically-driven winch, to which a manila rope is attached, which in turn carries the lead cable. By this means, 900 ft. of No. 0000 B. & S. gage cable, outside diameter, 2 in., is pulled at one time, as against the 300 ft., formerly possible. In passing through two intermediate manholes, the cable is greased to reduce friction. By this method the necessity of making two joints is obviated.

Cementing Off Water in Oil Wells

The necessity of shutting off water flows from water-bearing strata in petroleum wells is well recognized. Cementing is the process usually employed. Different methods of using cement are in force, according to *Technical Paper 32,* Petroleum Technology 3, of the U. S. Bureau of Mines. One of these is known as the pumping method. In this method the casing is drawn up from the bottom a foot or two; then a column of tubing, having a reducer or T-joint at its lower end, is lowered to a point about 2 ft. above the casing shoe. After testing to see whether the water will circulate between the outer casing and the wall of the hole and to remove injurious water or sediment, a mixture of cement and water of the proper consistency is pumped down the tubing. When sufficient water has been forced up between the tubing and the walls of the hole, a wooden plug is inserted in the tubing and forced down by pumping water above it until all the cement has been expelled from the tubing. The casing is then lowered to the bottom while pressure is kept up, the pump is disconnected, the tubing pulled out, and whatever mixture remains in the hole is immediately removed with a bailer. The cement should be allowed to set for about two weeks.

Occasionally, this method is modified by perforating the casing, pouring in cement and forcing it down with a wooden plug propelled by aid of the pump. The cement is supposed to follow the water through the casing perforations, and when the plug reaches the closed end of the casing, the cement has been driven out.

The cement plunger is also used for forcing in the mixture. The casing is raised and circulation tested as before. A plunger is then inserted. It consists of two iron disks connected by a cast-iron stem about two inches in diameter and three feet long. The disks are ¾ in. smaller than the casing, but are made to fit snugly by a ring of rubber belting around each. The mixture is pumped in and the disks are forced down. Then another iron plunger is inserted similar to the first except for a cup-shaped leather follower which fits snugly in the casing. The whole arrangement is then forced down by pumping water on the top of the upper plunger until the lower plunger reaches the bottom with its lower disk on the bottom of the hole and its upper disk about one foot inside the casing. The pressure is sufficient to force the cement past the upper disk of the lower plunger and up between its casing and the rock. The leather follower on the top plunger prevents the return of the cement through the casing. All the cement is forced out and upon the completion of setting the cast-iron disks are drilled out.

Another device is that known as the cement plug. In using this, the cement is conveyed to the bottom by a dump bailer and the casing raised above the top of the cement. The so called plug is then hung by a soft rope from a bailer. When the plug strikes the water, the weight of the bailer on a vertical valve stem through the center of the plug causes a bottom valve in the plug to open, thus allowing the water to pass through and the plug to descend freely. When the plug is below the bottom of the casing, two catches spring out on the side so that it cannot return and if a slight tension is exerted on the line, the plug is brought tight against the casing shoe, thus furnishing a closed point to the line of casing. The casing is then carefully lowered in the cement, which is forced up between it and the rock. After the casing is set in the cement, the bailer can be jerked from the plug. The cast-iron plug is drilled out after the cement has hardened.

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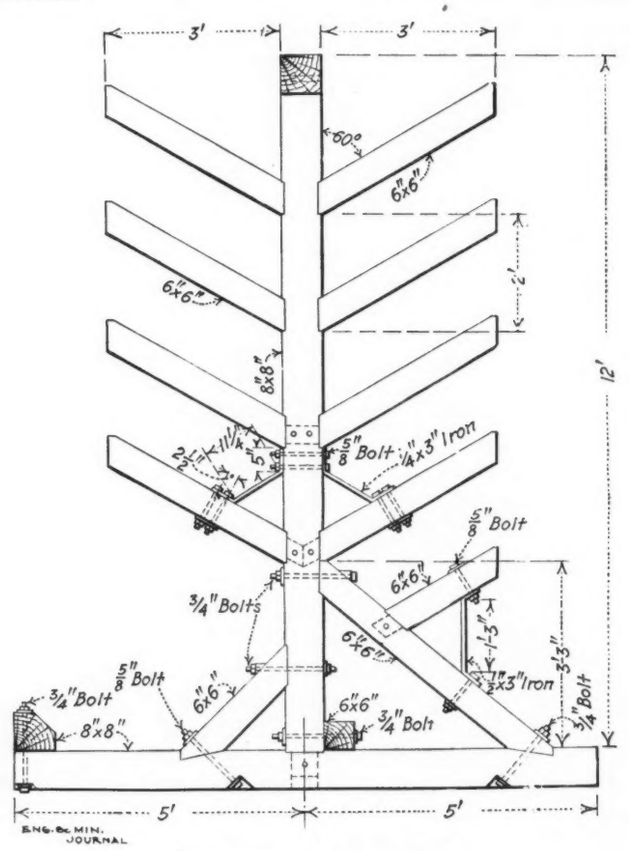
Pipe Rack

A satisfactory and convenient pipe rack for the mine warehouse is herewith illustrated. The larger pipes are stored on the base and lower arms, and lighter pieces on the upper arms. Iron bars and structural shapes may also, of course, be handled in the rack. The rack possesses the great convenience of permitting the pieces to be extracted either lengthwise or sideways, and by setting it in the middle of the room, both sides are made accessible.



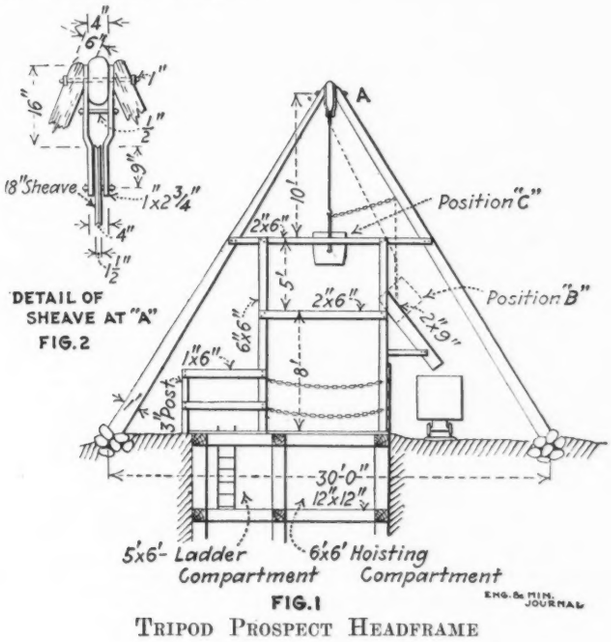
END VIEW OF PIPE RACK

The rack, as shown, consists of a number of bents spaced four feet apart. Six bents would thus give a length of 20 ft., sufficient to accommodate standard pipe. Five bents would probably be just as satisfactory. Each bent consists of a center post 8x8 in., with inclined pieces 6x6 in. symmetrically placed on each side. The base is an 8x8-in. by 10-ft. piece and suitable bracing is provided at the bottom. The line of bents is tied by a horizontal 8x8-in. piece along the top of the center posts, a 6x6-in. piece at its bottom and an 8x8-in. chamfered piece along the ends of the bases. The upper diagonal arms should be supported by iron braces similarly to the lower set, although these are not shown in the illustration. These 6x6-in. diagonal arms should also be all mortised into the center post with either inclined or square mortises, as shown on the lower two sets.

Tripod Headframe and Novel Bucket

By G. E. Le Veque*

A serviceable tripod headframe is made of three 32-ft. poles, having 12-in. butts. These are bolted at the top, as shown in Fig. 2, and a sheave hung from the 1-in. bolt. The bottoms of the poles are spread to form a 30-ft. equilateral triangle.



Tripod Prospect Headframe

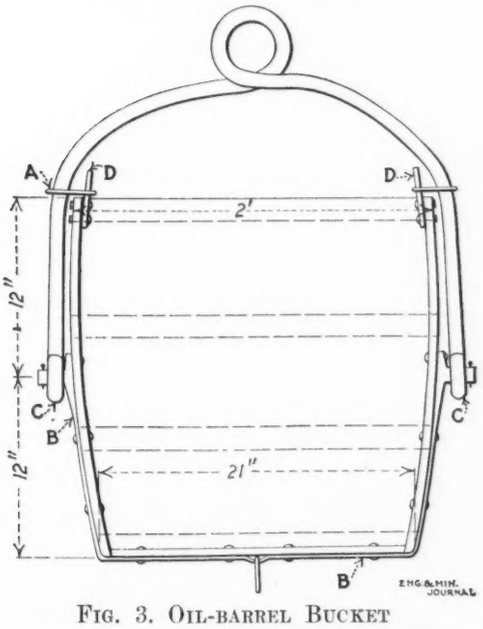


Fig. 3. Oil-barrel Bucket

The hoisting compartment is continued as a 6x7-ft. inclosure by 6x6-in. posts braced by 2x6-in. stringers, spiked to the tripod legs 9 ft. below the sheave. Eight feet above the shaft collar a landing and chute are built in, a space 4x4-ft. being left for the bucket and a platform built at one side for the lander.

The dumping device consists of a chain with a hook in the free end, fastened to a stringer directly over the chute. In operating, the bucket is hoisted to position *C*, as shown in Fig. 1, the chain is hooked in the bail ring and the cable slacked, transferring the weight of the bucket from the cable to the chain and bringing the bucket directly over the chute, where it can be dumped by overturning to position *B*. The length of the chain should be adjusted to allow the bucket to rest lightly on the chute when in dumping position and prevent its turning entirely over and dropping material into the shaft.

The bucket used with this headframe consists of the lower three-quarters of an oil barrel and holds about 4½ cu.ft. Its construction is shown in Fig. 3. A ¼x2½-in. band is riveted to the bottom and sides and serves to carry the pins *C*. The rings *A*, passed over the bail and the rods *D*, prevent the bucket from dumping accidentally.

For underground tramming, two buckets of this description are loaded together on a flat car, consisting of a platform built on an ordinary truck.

*Mining engineer, Inter-State Iron Co., Virginia, Minn.

Durability of Wood Pipe

Wood pipe is used around a mining plant for many purposes and accurate data on the life and service that can be expected are highly useful. Writing in *Engineering News*, Feb. 6, 1913, R. K. Tiffany describes the results obtained with wood pipe used for irrigation purposes.

A number of pipes examined had been buried from 4 to 8 ft. below the surface and covered with a puddled backfill of fine volcanic ash. The pipes were bored from Washington fir, spirally wound with flat iron bands, joined with steel collars and coated with a heavy coat of asphalt and sawdust. These pipes were removed in the winter of 1911-12, after 18 or 19 years of use. They were found to be, almost invariably, in good condition, with the exception of the two ends, which were occasionally partly decayed. The steel collars showed little damage from rust, and the ends of the pipe contained within the collars were, almost invariably, in good order. While these pipes were empty at least five months of every year, the soil surrounding them remained constantly damp and the interior of the pipe never became really dry. The pressure in no case exceeded 2 or 3 feet.

Another 4-in. pipe was of wood-stave, wire-wound, 2000 ft. in length, laid in 1902. It was built with inserted joints, laid at a depth of from 2 to 3 ft. in a dry volcanic ash. The head varied from 6 ft. at the upper end to about 60 ft. at the lower end. The coating was thin and light, having more the appearance of ink than that of a good pipe covering. This pipe was kept full of water from the time of installation for about two years, at which time it began to leak and was thereafter emptied during the winter. At the end of four years it was so badly decayed that it became necessary to replace it by a wood-stave pipe, wire-wound, with inserted joints, similar to the first, but with a good asphalt coating. The latter pipe has now been in use six years, being full during seven months of each year and empty during the remaining five months. It is in good order and shows no leaks of any consequence.

Another 13-in. pipe was of bored fir, spirally wound with flat iron bands joined with steel collars, and the whole covered with a good asphalt coating. This pipe,

2200 ft. in length, was laid in 1903 in soil similar to the above, with a covering of 2 to 2½ ft. The maximum head is 25 ft., the minimum 4 ft., and the average about 12 ft. It has been running full for seven months of every year since it was installed in 1903, and when recently inspected, the wood was firm and solid, the bands under the asphalt coating were bright and the collars were evidently in first-class condition. There was no evidence of leakage or decay at any point.

A 14-in. wood-stave pipe, wire-wound, with wooden collars also wire-wound, had a fairly good coating of asphaltum. Its length was 5200 ft., laid in very dry, sandy soil in the spring of 1908 at a depth of about 2½ ft. No water was carried during the first year and during the three years following the first 800 ft. of this pipe ran less than one-third full. The maximum head is 60 ft., the minimum 4 ft., the average about 15 ft. In the spring of 1912 it became necessary for the first time to carry a full head in the pipe and the first 800 ft. was found to be so decayed as to be entirely worthless and was taken up and replaced with new pipe. On the rest of the pipe many collars were found to be leaking badly, and were replaced or repaired with wedges. In some cases the water was found to be issuing in a jet between the staves of the collar and the staves of the pipe with such velocity that the wires had been cut entirely in two, making it necessary to reband the pipe for a short distance from the joint.

The last pipe examined was 22 in. in diameter, of machine-banded wood staves, 2300 ft. in length, laid not less than 2 ft. underground in soil similar to the last mentioned. The maximum head was 80 ft., the minimum 4 ft., the average about 35 ft. It was laid in the fall of 1906 and it has been giving continuous service since that time for seven months of each year. It has a good coating of asphalt and has given no trouble, except from occasional leaks at the wooden collars, which consist of staves about six inches long, with two to four steel bands at each collar, provision being made for adjusting the collars by thread and nut on one end of each band. It has been necessary to renew a number of collars. The conclusions drawn are:

The one great essential of continuous service from wood-stave pipe that is not kept filled throughout the year is a thorough and complete coating of asphalt on the outside. This coating must cover, not only the body of the pipe, but also all joints, collars or other fittings.

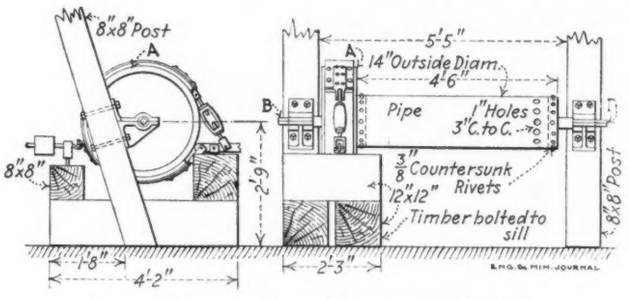
Wooden collars for joints have not given as good results as metallic collars. It has been difficult to secure a tight fit with the wooden collars and the additional thickness of the shell at this point and the break in continuity makes complete saturation of the joints impossible. The result is that decay starts at the joints and from there spreads until a leak develops. Leaks are rapidly enlarged by erosion, especially if the water carries silt or sand in any considerable quantities.

With a good heavy coating of asphalt, and the pipe running full throughout the irrigation season, it appears that absorption of water from the pipe by the surrounding soil is prevented; and well laid pipe under such conditions will probably last 20 years, possibly much longer. If a pipe has poor coating, or runs empty during a portion of the dry season, decay is very rapid. Wood pipe in mine service does not have to withstand the unfavorable condition of being empty part of the year.

Windlass for Timber Shaft

By L. D. Davenport*

The windlass shown in the accompanying drawing was constructed for the purpose of lowering timber and other material down a shaft. The drum is made of a piece of iron pipe 14 in. in diameter outside and 4 ft. 6 in. long. This is connected to a 2½-in. square axle by means of two iron castings, riveted to the pipe with ⅜-in. countersunk rivets. One of these castings is larger than the other and forms the brake wheel *A*. It is 28 in. in diameter with a 6-in. face and has a 2-in. shoulder turned to fit the inside of the pipe. The axle is made of 2½-in. square stock and is 7 ft. 2 in. long over all. The last 2 in. on each end *B* is made 1½ in. square to receive cranks used for turning the windlass; the next 8½ in. on each end is turned to 2½in. in diameter for the bearings, which are 2½x7½ in., and babbitted ¼ in.; and 5 ft. 5 in. is left in the center of the axle 2½ in. square. The brake band is of $\frac{3}{16}$x6-in. iron, 6 ft. 8 in. long, and is drilled with $\frac{9}{16}$-in. holes to allow eight basswood brake-block segments 2 in. thick, to be bolted to it. These basswood blocks last from eight months to one year. The



Iron Windlass for Lowering Timber

ordinary fulcrum, brake-band connections, and turnbuckle are used, as shown, and for applying the brake a ¾x3-in. lever 6 ft. long. A semicircular sheet-iron cover is placed over the brake wheel to protect it from the weather.

A ⅜-in. or ½-in. wire tiller-rope is used in the shaft with a 20-ft. length of chain on the end. In operation the timber truck is run up to the collar of the shaft and two half hitches are taken around the timber or lagging with the chain. One of the landers then raises the load by turning the drum with a cant hook in the 1-in. holes near one end, until the load slides off the truck into the shaft, the second lander meanwhile holding the weight by means of the brake lever. The load is steadied by the first lander and is then lowered to the bottom. Steel tram cars, weighing approximately 1½ tons, have been lowered easily and slowly with one of these windlasses.

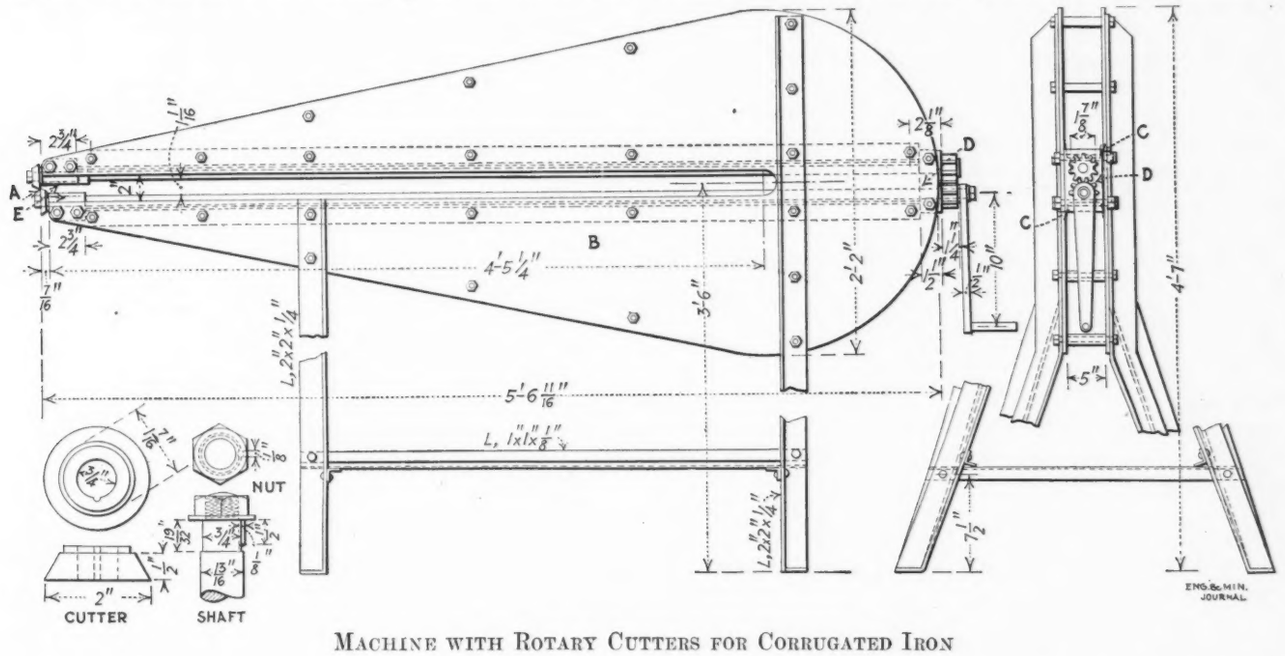
It is intended to arrange a set of gears, similar to an ordinary hand winch, on the brake-wheel end of the drum, so that a load can be raised off the timber truck without using the cant hook. For if the load drops even a very short distance, the lander using the cant hook is liable to be hurt. The first of these iron windlasses was made in 1910 in the shops of the Oliver Iron Mining Co., and was used in the Chisholm mine. They have proved highly satisfactory for the service demanded.

*Engineer, Ernestine Mining Co., Mogollon, N. M.

DETAILS OF METALLURGICAL PRACTICE

Machine for Cutting Corrugated Iron

The machine illustrated is used by the Doe Run Lead Co. at Flat River, Mo., and was designed for the purpose of cutting corrugated iron in any direction without deforming it. The actual cutting is done by two disks, the details of one of which are shown in Fig. 2. They are mounted on the ends of two shafts to form a cutting point at *A*. The machine consists of two vertical ¼-in. plates *B*, slotted horizontally and spread five inches by ⅜- and ½-in. bolts and spreader washers and two 5-in. channels *C* and mounted on a frame of angle irons as shown. The channels are used to stiffen the plates against lateral stress. There are bearing blocks for the $\frac{3}{16}$-in. shafts at each end. One block *D* at the rear is bolted between the plates and carries both shafts. Two blocks *E* are necessary at the front end,



MACHINE WITH ROTARY CUTTERS FOR CORRUGATED IRON

one for each shaft in order not to obstruct the passage through the slot of the sheet to be cut. The shafts are rotated by the handle and gears keyed to their rear ends. The cutters are frustums of flat cones made of tool steel and keyed to their shafts by round pins through the nuts on the end. As they are of smaller radius than the sheet corrugations, they ride over the latter, cutting but not deforming them.

The machine illustrated is used by the Doe Run Lead Co., of southeastern Missouri, and was devised by R. H. Wahl, mill superintendent.

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Corrugated Iron Pipe for Culverts is coming into use. This is made of extremely pure iron which offers higher resistance to corrosion, and by the use of corrugations, relatively thin metal may be employed without danger of collapse, according to Bull. 45 of the U. S. Office of Public Roads. The theory justifying its use is correct, but long-time service tests are not yet available.

The Power Plant of the Copper Queen Smeltery

The Douglas power plant of the Copper Queen is described by Charles Legrand, in *Bull.* 101, of the I. M. M. The boiler plant consists of eight 500-hp. water-tube boilers, equipped with economizers, and working at 155 lb., gage pressure. In addition, there are four 520-hp. boilers utilizing the waste heat of reverberatory furnaces situated 1300 ft. from the boiler house, generating steam at 180 lb. to allow for pressure drop. All the steam is superheated to 460° F. in a separately fired superheater, and reaches the engines at about 410° F.

The fuel used is California crude oil containing 18,400 to 18,500 B.t.u. per lb. and weighing 8.05 lb. per gal. (231 cu.in.) at 60° F. In regular operation, the heat content of the superheated steam over that of the feed-water to the economizers, is from 83 to 85% of the total heat in the fuel.

The boiler-feed pumps are electrically driven, and no feed-water heaters are used, the feed-water being taken from the condenser hotwell. The fuel-oil pumps and steam used in atomizing the fuel oil take approximately 4% of the total steam generated; the exhaust of the oil pumps is used to heat the fuel oil.

The power plant consists of 11 blowers, driven by tandem-compound engines; six of 300-cu.ft. capacity per revolution and five of 200 cu.ft. Each is piped separately to one furnace, and the quantity of air delivered is fixed by the speed of the blower, the pressure, usually 26 oz. per sq.in., adjusting itself to the condition of the furnace.

There are six blowing engines for the converters, five of 6000 cu.ft. per min. capacity and one of 12,000 cu.ft.

per min. These engines have cross-compound steam cylinders and duplex air cylinders. They deliver air at 11 lb. pressure to a common main pipe; the speed of the engines is varied by an air governor to keep a constant pressure.

There are four 400-kw., direct-driven, 260-volt generators, connected to cross-compound steam engines. The current is distributed to the various departments by independent feeders equipped with integrating wattmeters, so that power used on any line can be measured. There are in use between 50 and 60 stationary motors, 7 electric cranes and 14 electric locomotives.

In addition to the direct-current generators there are two 750-kw. mixed-pressure turbines, delivering a 60-cycle, three-phase, 2300-volt, alternating current, transmitted at 44,000 volts to a mine 67 miles away.

All the engines are equipped with individual ejector condensers; they can also be connected to a common exhaust pipe, which takes the exhaust steam at approximately atmospheric pressure and delivers it to turbines; the engines so connected are then running noncondensing, and the number of engines connected to turbines is varied, according to the load. If there is more exhaust steam than is needed by the turbines, it is automatically bypassed direct to a turbine condenser, and if there is not enough exhaust steam for the turbine load, high-pressure steam is admitted automatically to a separate set of nozzles acting on the same turbine wheel as the exhaust steam. The turbine condensers are of the barometric jet type, with separate dry-air pump to maintain a better vacuum than is practicable with ejector condensers.

The circulating condenser water is cooled by a natural-draft cooling tower, and two sets of pumps are used, one for pumping from the hotwell to the top of the cooling tower, and one from the tank under the cooling tower to the condensers. The speed of the pumps is automatically regulated according to the demand for water.

The average power developed by the plant for the first five months of 1912 was 4700 i.hp., which required 13.65 lb. of steam per indicated horsepower-hour. The oil burned was 1.125 lb. per indicated horsepower-hour, including that (about 1% of total) for generating steam used in various parts of plant outside of power and boiler house. Of the 4700 i.hp. generated, between 6 and 6¼% are used by boiler-feed pumps, economizers, scrapers, condenser-water circulating- and air-pumps, and lighting of boiler and power houses.

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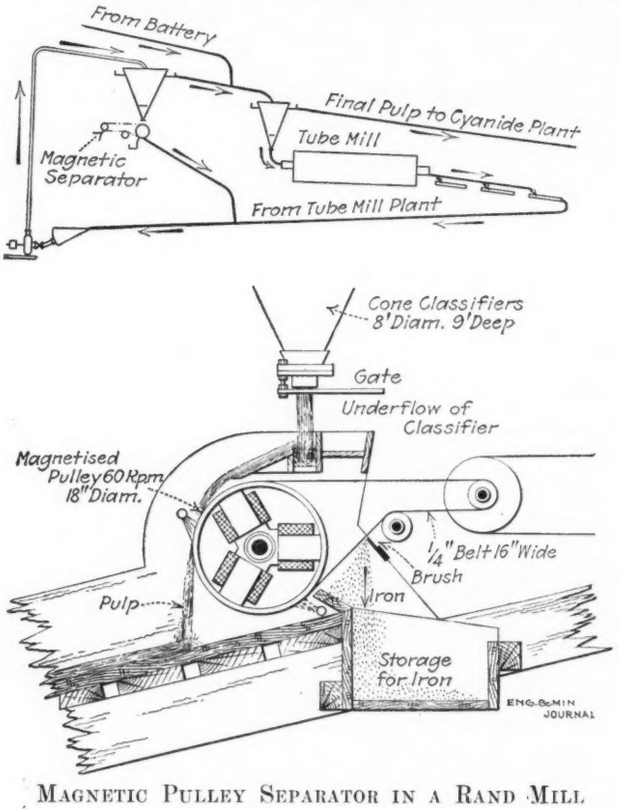
Method of Cleaning Screens and Filter Leaves

A recent invention of Maynard J. Trott, Colorado Springs, Colo., (U. S. pat. 1,052,191) assigned to the Dorr Cyanide Machinery Co., Denver, Colo., provides a method of cleaning filter leaves, and screens of stamps, chilean mills, etc. The method consists essentially of drying the filtering fabrics, screens, etc., so that the coatings of lime and slime become brittle, and then subjecting them to the abrasive action of sand violently projected against the surface. The inventor claims that the adherent matter is speedily and thoroughly removed from both inner and outer surfaces of screen or fabrics by the sand blast, but the force of the latter is not sufficient to penetrate the fabric.

Magnetic Separator in Tube-Mill Circuit

The quantity of small particles of iron that may enter into a closed tube-mill circuit originating from attrition within the mill, soon amounts to a large total, unless some means of eliminating it as fast as discharged from the tube mill is provided. The material used within the tube mill, and which becomes subject to attrition, is of the toughest of steels, and, therefore, resists grinding action within the mill to such an extent, that it is repeatedly passed through the circuit, before being ground fine enough to be carried into the overflow product of the cones. In order to remove the accumulation of coarse metallic iron particles, a magnetic separator has been used in the Simmer & Jack mill on the Rand, and, according to C. O. Schmidt, in "A Textbook of Rand Metallurgical



MAGNETIC PULLEY SEPARATOR IN A RAND MILL

Practice, Vol. 2," as much as 900 lb. per day of metallic iron has been removed from the tube-mill circuit. This amount is nearly equal to the whole consumption of about 0.4 lb. of steel per ton of ore milled per day.

The details of the magnetic separator and its position in the tube-mill circuit, are shown in the accompanying illustration. Before this magnetic separator was adopted at the Simmer & Jack mill, the accumulation of iron from the continuous wear of shoes, dies, liner plates and other parts in the crushing plant, became so great that it was found necessary to pass regularly once per day, for a period of about 15 min., the whole pulp to the cyanide plant without recrushing in the tube mills, in order to clear the tube-mill circuit of the accumulation of iron.

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The Availability of White Lead as a Pigment for Iron and Steel is decreased by its lack of elasticity. It should never be used as a grounding pigment, says the "Engineer," Mar. 7, 1913, as it does not cling to the metal at all firmly.

NOTES FROM CURRENT LITERATURE

Platinum Osmium Alloy

In order to avoid the use of expensive iridium for alloying with platinum to secure great hardness, Fritz Zimmerman, of Newark, N. J., has suggested using osmium in its place, and has received U. S. pat. No. 1,055,119, covering the process.

Experiments have been made using many proportions of osmium, from ½ of 1% to 10%. Alloys containing more than 10% osmium are workable only with difficulty, while those containing more than 30% are brittle and hardly workable at all.

As far as hardness is concerned, one part of osmium is claimed to be equal to 2½ parts of iridium in the platinum alloy. As the demand for osmium is not great, it can be obtained at lower cost than iridium and its alloy is the equal of the latter as regards hardness and tensile strength, and said to be more resistant to acids than platinum alone. For alloying platinum and osmium, it is necessary to bring both metals to a high degree of purity in order to remove elements which impair the good qualities of the alloy.

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Comparative Characteristics of Copper Minerals

The following sulphide minerals common in copper ores are primary, i.e., they are products of original precipitation, probably from ascending, heated, alkaline solutions: pyrite, pyrrhotite, chalcopyrite, bornite, chalcocite, enargite, tetrahedrite, tennantite, sphalerite, galena, and probably covellite, say Messrs. Graton and Murdoch in a paper presented before the February meeting of the American Institute of Mining Engineers. Of these, the following, so far as observed, are invariably primary: pyrite, pyrrhotite, tetrahedrite, tennantite, sphalerite and galena.

The following minerals are secondary, i.e., they are derived by the action of descending, cold, acid waters upon the other sulphides, resulting in secondary sulphide enrichment: chalcopyrite, bornite, covellite, chalcocite and enargite. None with the doubtful exception of covellite, is invariably secondary. In no case has a secondary sulphide been observed developing except by replacement of another sulphide mineral.

Resistance to enrichment among the copper-bearing sulphides decreases in the following order: chalcocite, enargite, tetrahedrite and tennantite, covellite, chalcopyrite, bornite. Of the sulphides developed secondarily, chalcocite is by far the most common and abundant; covellite is common, but not usually present in large amount; chalcopyrite is not uncommon, but rarely abundant; bornite is rare and generally sparing in amount; and enargite is very uncommon and in insignificant quantity.

Stability of the secondary sulphides in the presence of acid, cupriferous solutions therefore decreases in order as follows: chalcocite, covellite, chalcopyrite, bornite. Enargite has the anomalous character of being rather resistant to alteration, but difficultly regenerated. The instability of bornite, as regards both ease of decomposition and difficulty of secondary formation, is especially noteworthy.

Under the usual conditions of enrichment, secondary chalcopyrite forms but sparingly, and secondary bornite little, if at all. The evidence at hand indicates that the secondary formation of these two minerals is most favored in the farthest or deepest portions of the zone of enrichment; and it is possible that deficiency of acid in the cupriferous solution is the cause of such secondary production.

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Precipitation of Gold and Silver by Metallic Minerals

While the reducing action of organic matter, of ferrous sulphate and of hydrogen sulphide have frequently been invoked to account for the deposition of native gold and silver from ore-forming solutions, the high efficiency in this respect of certain of the metallic minerals which form the ore itself has not been sufficiently recognized. Experiments undertaken along this line are described in a paper by Chase Palmer and Edson S. Bastin before the February meeting of the American Institute of Mining Engineers.

The conclusions arrived at are, that certain sulphides, arsenides, and sulph-arsenides of copper, nickel and cobalt precipitate metallic silver very efficiently from dilute aqueous solutions of silver sulphate. As the waters descending through the upper portions of most sulphide orebodies are known to be sulphate waters, similar precipitative actions would be expected under natural conditions. The frequent association of silver in ore deposits with chalcocite and bornite and particularly with niccolite and cobaltite, minerals which in these experiments were among the most efficient precipitants, warrants the belief that such reactions are of great importance in secondary enrichment of orebodies.

The more common sulphides such as pyrite, galena and sphalerite were relatively inactive as precipitants of silver from aqueous solutions of its sulphate.

The quantitative results obtained with niccolite and chalcocite indicate that the essential chemical changes in reactions of this type are due to oxidation through the hydrolytic action of water. It is apparent, therefore, that certain water solutions may act as potent oxidizing agents below the ground-water level.

The experiments indicate that nearly all of the sulphides and arsenides common in ore deposits are capable of reducing gold from a solution of its chloride, although important differences in the rapidity of the precipitation were observed with different minerals. Most of the minerals that are especially efficient as precipitants of silver are also effective precipitants of gold and a number of

other minerals such as galena, pyrite, stibnite and millerite that are inefficient in precipitating silver are efficient in depositing gold.

It is known that the waters descending through the upper portions of sulphide orebodies universally carry chlorides and it is probable that these chlorides have effected the solution of the gold. It is probable, therefore, that phenomena similar to those exhibited in the experiments with gold chloride solution play an important part in secondary enrichment of gold.

While the phenomena here described find their most immediate application in secondary enrichment it is perfectly possible that such reducing effects of the sulphides may be responsible in part for the primary association of the precious metals with certain sulphides in preference to others. It is recognized, of course, that certain mineral associations in ore deposits are probably the result of processes analogous to differentiation in rock magmas but it is quite possible that other associations such as the apparent preference of gold for chalcopyrite and tetrahedrite rather than for pyrite in deposits carrying these three minerals may be due to differences in the reducing power of these sulphides themselves. Light could probably be thrown upon this point by the investigation of the reducing effect of various sulphides upon silver and gold salts dissolved in solutions having the composition of certain deep mine waters. The effect of increase of temperature on the reactions should also be noted.

Expiration of French Cyanamide Patents

The first patent for the manufacture of cyanamide by the action of nitrogen on metallic carbides or their elements was applied for by Doctors Frank and Caro on June 12, 1899 (Pat. 289,828), and consequently will not expire until June 12, 1913, says the *Journal du Four Electrique*. However, the Société des Produits Azotes, licensee of the General Cyanamide Company, of Rome, has also the patent 319,897, of Mar. 24, 1902, "Application of Nitrogenous Compounds as Manures," which expires Mar. 25, 1917. This patent protects the sale of cyanamide in France until Mar. 25, 1917. Consequently, foreign-made cyanamide cannot be sold in France before that date. Moreover, the Société des Produits Azotes has the important French patent number 382,743, with additions 8,338 and 8,340, the date of application being Oct. 10, 1907, expiring Oct. 11, 1922. This patent was granted to the Italian Cyanamide Company, of Rome, by the "Patentamt" in Germany, after a long discussion, on October 29, 1910, under the number 227,854.

Road Making Materials

An examination of various rocks used for macadamizing has been made by the U. S. office of public roads under the direction of the Department of Agriculture. A description of the tests is given by *Engineering & Contracting*, Feb. 5, 1913, in an abstract of a paper by E. G. E. Lord, presented at the Cleveland meeting of the American Association for the Advancement of Science. It is stated that the physical difference in various rocks applied to macadamizing is particularly noticeable in the shapes of their smaller fragments or screenings. Coarse-grained rock, such as granite, gabbro and gneiss, gives cubical or rounded fragments which are rather coarse; whereas, fine-grained, igneous rock, such as rhyolite, diabase and andesite, gives splintery or wedge-shaped fragments as a result of greater toughness, due to the dense interlocking structures of the mineral components. In the road these splintery fragments of fine-grained rock make a firmer and more permanent bond with the coarser road stones than do the cubical fragments. This bond may be termed the "mechanical bond" as distinct from the cementing or binding effect produced by fine rock dust. This latter is caused by adhesive colloidal silica and hydrated silicates. Under the severe conditions of modern road traffic, this natural bond has had to be supplemented by bituminous or other organic road binders. It has been found, however, that certain artificial inorganic substances, such as basic slag, have excellent binding qualities. This is especially true of the extremely basic, dark-brown slag produced in the manufacture of steel by the basic-openhearth process. This material, when ground, will harden under water in much the same manner as portland cement, and, in conjunction with ordinary blast-furnace slag, it forms an excellent road binder.

Properties of Carbon Monoxide

The commonly accepted idea that carbon monoxide is a tasteless, odorless gas is disputed by R. W. Merriman (Chem. Soc. *Proc.*, p. 33, 1913; abstr. *Journ.* Soc. Chem. Ind., p. 231, Mar. 15, 1913): Carbon monoxide was prepared by slowly delivering pure formic acid below the surface of concentrated sulphuric acid kept at 60° C. The gas was passed through four Drechsel flasks containing 30% sodium hydroxide, and was collected over water in a large gas holder. Although always described as an odorless and tasteless gas, this specimen had a perfectly definite metallic odor and taste. The idea occurred to the author that it might contain a small quantity of the unknown formic anhydride. This substance would have the properties of an aldehyde, so the following experiment was performed. The gas was bubbled through a series of Drechsel flasks containing the following solutions: Sodium hydroxide, decolorized rosaniline, sodium hydroxide, again, Fehling's solution, and ammoniacal silver nitrate. The decolorized rosaniline was not altered, but the silver nitrate and Fehling's solution were at once reduced. Carbon monoxide prepared from oxalic acid, from potassium cyanide, from sulphuric acid and sodium formate, and from lactic and malic acids, gave similar results. As a final test, 40 liters of carbon monoxide were prepared by slowly passing pure carbon dioxide through a tube 80 cm. long packed with charcoal heated to bright redness. In this experiment formic anhydride could not have been produced. The resulting gas was washed as before, and possessed the same properties. It follows that pure carbon monoxide possesses a perfectly characteristic odor and taste, and readily reduces Fehling's solution and ammoniacal silver nitrate solution. It has no action on decolorized rosaniline.

The Oil-bearing Area of the De Beque Field in Mesa and Garfield counties, Colorado, is but a few square miles, according to the U. S. Geological Survey. From the 10 wells operating the flow of oil is but a few barrels per year and the production of gas is small.

Driving with Machines on Tripods

By Theodore V. K. Swift*

SYNOPSIS—At the Witherbee-Sherman iron mines near Mineville, N. Y., a face seven feet wide and eight feet high is carried through hard gneiss and magnetite by two piston machines mounted on tripods. A third machine follows and enlarges the tunnel width to nine feet. Face drilled with a vertical cut and broken with 45% and 60% dynamite. Mucking completed in half the time of the drilling.

A description of the methods used by Witherbee, Sherman & Co., Inc., Mineville, N. Y., in driving an 8x9-ft. haulage tunnel in exceptionally hard rock may be of interest to mining men who have similar work to do.

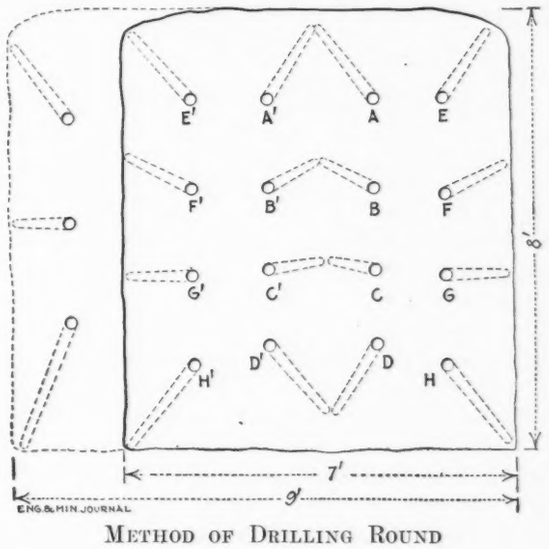
The character of ground drilled is a mixture of unusually hard granitic gneiss with hard magnetite. The granite is very difficult to drill but breaks fairly well, while the magnetite drills more easily but does not break so well. The ore in the tunnel varies from a few inches up to eight or 10 ft. in width but through the last 200 ft. the ratio of granite to magnetite is approximately 3:2. Two 10-hr. shifts are worked with an hour between each shift and an hour for dinner.

Face Drilled by Two Machines on Tripods. A Third Machine Follows and Slabs off

Two Ingersoll-Rand C-100, butterfly-valve, 2¾-in. machines, mounted on tripods of the Rand type, are used to drill the face and are operated by a drill runner and helper for each drill. The face is carried seven feet wide and eight feet high and a third machine is employed to follow up these two heading-machines and bring the tunnel to the proper width of nine feet. This machine is not run steadily. During one month it was capable of doing its work in an average of two shifts per week. This method is found to be quite advantageous over the method of carrying the face to the full width of nine feet as the tunnel advances, for this third or "trimming" machine can put in long side holes and break the ground more efficiently than if the holes are put alongside the other breast holes. This widening by the third machine is done on whichever side of the tunnel has the sharpest curvature, thus tending to ease the curves somewhat, as the tunnel follows the ore.

Vertical Cut Used in the Heading

Sixteen holes are needed to break the 7x8-ft. section. These holes average 4½ ft. in depth. Repeated efforts with deeper holes showed it to be impossible to break them to their full depth. The round is drilled approximately as indicated in the accompanying drawing, the dotted lines showing the work done by the trimming machine, whose 8- or 10-ft. holes it is easy to bring because of the free side-face to break to. Much difficulty is experienced in drilling this hard rock and it often requires two or three starters and generally more than one second drill on each hard "upper." This round is drilled and fired once every 10-hr. shift and although the footage per drill may seem low, it is, nevertheless, a good shift's work, considering the unusual nature of the ground. Tripods are used simply because the nature of the work in other parts of the mine is not suitable for a column or bar and neither of these rigs is included in the mine equipment. One setup is generally sufficient to allow each machineman to drill his half of the round. A hitch is cut in the floor with a piece of hand steel for the point of the forward leg to rest in, a wooden block is buried in the muck as a foundation for the hind leg and the third or outside leg is thrown up against the side wall and does not rest in any hitch, thus leaving the whole rig free to be moved out of line, if necessary, when changing steel. Eight cut holes for the vertical cut are drilled and are bottomed as nearly as possible in pairs, *A* with *A'*, *B* with *B'*, etc. Outside of these, eight side holes are drilled to break even with the bottoms of the cut holes. Each machine is started on the top holes and lowered as the holes are drilled, one setup being sufficient for each machine with the necessary swinging of the machines in the saddles and adjustments of tripod legs. An air pressure of 60 to 70 lb. is maintained at the face.



Method of Drilling Round

Fuse Blasting with Dynamite of Two Strengths

Du Pont 60% Repauno gelatin dynamite is used in all cut holes and du Pont 45% Pepauno gelatin dynamite is used in side holes which are not too heavy, all sticks being split and thoroughly tamped as they are put in the hole. All holes are fired with du Pont No. 6 blasting caps and du Pont double tape white fuse. In all cases the primer is put in the hole next to the last, with one stick on top of it, and all holes are thoroughly tamped with fine wet ore in standard du Pont paper bags. Holes *A A'*, *B B'* and *C C'* are spit first and as nearly simultaneously as possible. *E E'*, *F F'* and *G G'* with fuses cut four inches longer are spit next and the lifters *D D'* and *H H'* with fuses four inches longer than the side holes are spit last in order to throw the muck back as far as possible from the face. It requires two men to light these holes properly. All powder is prepared and all holes are

*Mine captain, Witherbee, Sherman & Co., Inc., Mineville, N. Y.

loaded and spit by the regular mine powder-monkey with the help of one of the machinemen.

MUCKING COMPLETED IN ONE-HALF OF EACH SHIFT

All mucking, tramming and track laying is done by three muckers who work half a shift only and are then moved to some other part of the mine. At the beginning of each shift these men are sent directly to the face and muck back sufficiently for the machines to be set up while the machinemen are assembling their rigs, connecting hose, etc. Permanent 45-lb. rails in 30-ft. lengths are laid on 4-in. ties as the tunnel advances. Two sets of 15-ft. 45-lb. rails and one set of 5-ft. 45-lb. rails are used temporarily to keep the track as close to the face as possible. Koppel 2½-ton, 22-cu.ft. capacity cars are used and are trammed to a side track where an electric locomotive hauls them to the portal of the tunnel. Short-handled shovels and no muck-plates are used.

TUNNELING COSTS FOR MONTH OF OCTOBER, 1912

Footage.....116.5 feet

			Cost per Foot	
Labor:				
Drill runners @ $2.50	$280.50			
Drill helpers @ $1.95	218.78			
Total drilling	$499.28		$4.29	
Muckers @ $1.95	149.77		1.29	
Total		$649.05		$5.58
Supplies:				
Powder	285.97			
Caps	5.07			
Fuse	14.41			
Total		$305.45		$2.62
Miscellaneous:				
Air, 112 machine shifts @ $1.50		168.00		1.44
Drill sharpening, 112 shifts @ $0.20		22.40		0.19
⅛ foreman's time @ 3.05		54.90		0.47
⅛ powder monkey's time @ 2.50		45.00		0.39
Total		$1244.80		$10.68

Note—Air and drill-sharpening costs are figured from the average cost per machine shift for the seven preceding months.

Detailed costs for the month of October, 1912, are given in the table. This is not phenomenally cheap or rapid driving but under the unusually disadvantageous conditions, especially the hard formations, it was considered satisfactory.

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Adventure Consolidated Copper Co.

The report of the directors of the Adventure Consolidated Copper Co., for the year ended Dec. 31, 1912, shows a production of 8,727,312 lb. of copper. Sales of copper and silver amounted to $1,351,185 lb. Total receipts were $3,658,036. Total expenditures from date of organization were $250,000 paid for mining property, $3,213,850 for mining expense and construction, and for all other expenses, $187,551, making a total of $3,651,402. The operations of the mine during the year have been confined to a continuation of the exploratory work of 1911 toward proving the Adventure lode. The entire work has been carried on from No. 5 shaft, which attained a depth of 1500 ft. in 1911. At this stage sinking was discontinued and the exploration of the second and third lodes was carried on by a crosscut from shaft No. 7. This crosscut was advanced to 1151 ft. from the shaft during 1912, cutting three amygdaloid lodes carrying copper, called Nos. 2, 3 and 4 lodes, respectively.

On Nov. 1 a diamond-drill hole was started vertically downward from the bottom of No. 5 shaft, to determine the character of the various lodes under it. Two amygdaloids were cut which carried fairly good quantities of copper at a depth of 658 and 764 ft., respectively. At present, not enough information is to be had about them to correlate them with the other Adventure lodes. This drill hole is now 846 ft. deep and is being driven further.

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Goldfield Consolidated in February

The total production of the Goldfield Consolidated Mines Co., for February, at Goldfield, Nev., was 26,711 tons, containing $567,357, or $21.24 per ton, of which 24,840 tons was milled with an extraction of 93.17%, and 1871 tons was shipped of an average value of $20.93 per ton, the net recovery from all ore being $19.89 per ton. The net realization was $348,853, or $13.06 per ton. The total cost of mining, development, transportation, milling, office and general expense was $6.99 per ton, distributed as shown in the accompanying table.

OPERATING COSTS AT GOLDFIELD CONSOLIDATED, FEBRUARY, 1913

Mining, including stoping and development	$3.23
Transportation	0.08
Milling	2.01
Marketing	0.08
General expense	0.38
Bullion tax	0.15
Construction	0.30
Marketing ore	0.80
Total cost of operation	$7.03
Miscellaneous earnings	0.04
Net cost per ton	$6.99

According to the monthly report of the general manager, Albert Burch, development work totaled 2757 ft. In the Combination mine the sill of the 136BX stope on the second level, 350 ft. north of the shaft, was extended, and produced 1247 tons of $22 ore. The downward extension of this ore has been intersected by several raises, and stopes are being cut from the lower end up to the 136 BX sill. The 215 FX raise and stope produced 449 tons of $16 ore. The diamond drill was started from a station about 350 ft. east of the shaft on the 380-ft. level, and a hole was drilled southeasterly at a dip of 48° to intersect, if possible, the downward extension of the Reilly streak.

The 448 crosscut, in the footwall of the Mohawk 490-R stope, 50 ft. lower than the 446 crosscut referred to in last month's report, encountered the downward extension of the same oreshoot and produced 63 tons of $20 ore. A sill is now being cut on the intermediate level, and a stope started in the ore. The 303-M raise, in the Laguna, driven into the hanging wall of the 337 intermediate to prospect for the downward continuation of the new oreshoot described in last month's report, cut 6 ft. of $17 ore. This new oreshoot is now exposed by raises for 100 ft. on its dip. Other raises and drifts are being driven to determine its further extensions.

In the Clermont-Jumbo, the 420 stope, under the 413 sill, 700 ft. south of the shaft, again produced a large tonnage of good ore, and held the average grade of the Clermont up to $36.63 per ton. The 604-W stope on the downward extension of the 534 oreshoot produced 431 tons of $51 ore. The 802-A sill was extended and produced 483 tons of $50 shipping ore. The 907 intermediate, under the 802-A sill, encountered the downward extension of the 802 oreshoot. No attempt will be made to open a stope on this ore until better facilities for ventilation can be provided. Prospecting for the downward extension of the 802 oreshoot continues on the 1400-ft. level.

New Mine and Metallurgical Construction

Olive Mines Co.—This company, operating a mine in Pima County, Ariz., is building a concentrator.

Relief Gold Mining Co.—A 50-ton cyanide plant will be built at this company's property near Phoenix, Arizona.

Brunswick Mining Co.—A 20-stamp mill is to be built at this mine at Grass Valley, Calif.; C. H. Mallen, manager.

China Hill Mining Co.—A 5-stamp mill has been completed at this property, five miles south of El Dorado, California.

Calaveras Copper Co.—The 600-ton mill and 150-ton smeltery have been completed at a cost of about $400,000. The mill has been running for about four months and the smeltery was blown-in early in March.

Union Leasing Co.—Plans are being drawn for a mill to be built by this company at the Gold Sovereign mine at Cripple Creek, Colorado.

Idora Hill Mining Co.—A 50-ton concentrator is to be built at this company's property near Wallace, Idaho.

American Zinc, Lead & Smelting Co.—The new Hillsboro, Ill., smeltery is ready for full capacity operations and should produce about 50 tons of spelter per day. The new 1000-ton mill, in Tennessee, is expected to be completed early in May.

Hidden Lake Mining Co.—A 50-ton cyanide plant is being planned for this property at Cable, Montana.

Drumlummon—A new cyanide plant is being built at this property, at Marysville, Mont., and will probably be completed the latter part of April.

Oro Fino—Plans are being made for a mill for this property near Rochester Cañon, Nevada.

Buckhorn Mines Co.—Contracts have been let for building and equipping a 350-ton gold mill, at Buckhorn, Nev. The mill was designed by J. W. Hutchinson, general superintendent of the Goldfield Consolidated mill, and Frederick J. Siebert, consulting engineer for the various companies controlled by George Wingfield. S. J. Kidder, formerly in charge of the Pittsburg-Silver Peak mill, is superintendent.

Uwarra Mining Co.—Work has been begun on a 50-ton gold mill; Percy E. Barbour, manager, Candor, N. C.

Oriole Mining Co.—A 10-stamp mill will be built at this mine, near Galice, Josephine County, Oregon.

Ophir Hill Mining Co.—The mill is being enlarged to 300 tons capacity, at this property, at Ophir, in Tooele County, Utah.

Swastika Mining Co.—The new mill of this company, at Swastika, Ontario, is in operation. It contains five stamps and has a capacity of 25 tons of ore per day, but was built to accommodate 10 stamps.

McIntyre Mines, Ltd.—The new mill at Schumacher, in the Porcupine district, Ontario, was completed early in March.

North Carolina Partridge Smelting Co.—This company is planning to build a smeltery at Charlotte, N. C.

Dome Lake—The 10-stamp mill at this Porcupine property, will probably be ready to be put in commission early in April. Thomas E. Selby, formerly of the Dominion Reduction Co., at Cobalt, has been appointed mill superintendent.

Gold King Mining Co.—A 5-stamp mill is being planned for the property of this company at Joy, Nev. August Munter is general manager.

King & Queen—A 40-ton mill unit for the treatment of copper ore has just been built at this mine, at Carter, Montana; C. B. McKinnon, manager.

Oro Water, Light & Power Co.—Electrically operated dredges are being planned by this company, to be built for operations in Humboldt and in Shasta Counties, California.

McEnaney—Enlarging the present 10-stamp mill, in which only five stamps are now installed, to 20 stamps, is planned for this summer at this mine in the Porcupine district, Ontario.

Wicks—Plans for a mill are being drawn for this property, at Hillsboro, N. M.; A. G. Veig is manager.

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Miami Copper Company

The report of the Miami Copper Co. for the year ended Dec. 31, 1912, shows that a profit of $2,094,805 was made, out of which three dividends, aggregating $1,100,112, were paid.

The work in the mine was carried forward with the view of mining by the shrinkage-stope method, as soon as the irregular top layer of the ore next to the capping could be removed by timbering methods, and a timber mat formed. This work, while expensive, was nearly completed in the northwest portion of the orebody, containing approximately 2,000,000 tons, and active mining by the shrinkage-stope method was to have been begun in March, 1913. General Manager Gottsberger states that this will result in lower mining costs. After the first series of shrinkage-stopes is completed, other portions of the mine will be made ready for additional stopes, and thus the larger part of the production will be by this cheaper method.

During the year, 54,929 ft. of development work was done, divided as follows: 37,170 ft. in drifts; 17,419 ft. in raises, and 340 ft. in shafts. The development work consisted in the completion of the 420-ft. extraction level and the sublevels and raises in the Northwest orebody; in extending this level to the Captain orebody and the starting of several haulage drifts in it; also the putting up of a raise from this level to the bottom of the Captain shaft. The Captain, or No. 1 shaft, will be extended full size to the 420-ft. level, and will be used to help in the development of the Captain orebody, which contains approximately 4,000,000 tons of ore. This will be mined directly on the shrinkage-stope method, without the use of a timber mat. Much full-sized drifting was done on the 570-ft. level, so as to prepare it for a main extension level. A station was cut at the 720-ft. level at No. 4 shaft, but as it will be several years before the ore tributary to this level will be needed, the work of driving the crosscut was not started.

During the year, 21 churn-drill holes were put down from surface to an average depth of 612 ft., and in addition to this, one hole was put down 269 ft. from the bottom of No. 1 shaft. Part of these drill holes encountered high-grade ore, and part of them demonstrated the existence of a belt of 1.2% copper material, 500 ft. in width, lying to the north of the Northwest orebody. While this material is not classed as ore, its copper, together with its pyrite contents, may some day make it of value.

In order to determine the extent and continuation of the ore below the 570-ft. level, nine vertical diamond-drill holes, with a total length of 1957 ft., were put down below that level, all of them being in good sulphide ore, averaging 2.5% copper for varying depths. The deepest point at which ore was found was 115 ft. below the 720-ft. level, the deepest extraction level as yet laid out at No. 4 shaft. The ore is evidently pitching to the east, and diamond-drill holes have been projected to cut it on its continuation in that direction. Underground development drifts have proved up the Northwest orebody and the area of the main orebody on the 570-ft. level. On Jan. 1, 1913, the ore reserves were estimated at 20,800,000 tons, running 2.48% copper.

The ore milled during the year was derived from the following sources: Stock pile, 118,130 tons; development, 244,504 tons; square sets and slicing, 450,209 tons; shrinkage stopes, 228,926 tons. The results of the milling operations for the year were as follows: Ore milled, 1,040,744 tons at 2.393% copper; concentrate produced, 46,683 tons, at 37.020% copper; copper in concentrate, 34,560,665 lb.; copper per ton of ore, 33.21 lb.; mill extraction, 69.39%. From the concentrate produced, the net smeltery returns of refined copper amounted to 32,832,609 lb. Based on the smeltery returns, the cost of refined copper in concentrate on board cars at Miami was as follows: Mining, $1.20 per ton of ore, or 3.8c. per lb. of copper; milling, 65.9 per ton of ore, or 2.09c. per lb. of copper; general, 18c. per ton of ore, or 0.58c. per lb. of copper, making a total of $2.04 per ton of ore, or 6.5c. per lb. of copper.

The sixth and last section of the mill was started about the last of February, 1912, and during the year, the average section product per day was 489 tons of ore. During certain periods, this was greatly exceeded, at times being 524 tons per section per day. The ore is hard to crush and the rigid rolls used for the intermediate crushing were partially replaced by a heavy type of spring roll and the chilean mills by Hardinge pebble mills. This change was completed in the early part of 1913, and it is believed will result in a large decrease in the cost of crushing.

Two important experiments were carried on in the sixth section, treating its whole product of approximately 475 to 500 tons per day. The first was the use of the so called roughing process; it was demonstrated that no greater extraction nor lower cost could be obtained by it. The second, or retreatment process, consists in finer grinding of the coarser sands from the sand-floor reject and middling, followed by classification and table treatment. This plant is still in operation and shows an increased saving of about 1½ lb. per ton of ore in section six over the other sections. The costs of these experiments were charged to operating, as well as the mill betterment in the way of new crushing machinery.

In the power house, there were installed during the year a third 1000-kw. Nordberg-Crocker-Wheeler reciprocating-engine generator set, a second Nordberg steam-driven 4000-cu.ft. air compressor, a second Nordberg counter-current condenser, and a fourth 600-hp. water-tube boiler with economizer. The temporary mine shops at the No. 2 shaft were abandoned, and the machinery there, together with several new tools, was installed in a new steel and corrugated-iron shop near the collar of the main or No. 4 shaft. A substantial frame building was also erected near No. 4 shaft for the use of the mining engineers and the mine foremen. It is provided with a vault for the protection of the mine maps and keeps the foremen in close touch with the engineers and the maps.

Work was begun on remodeling the coarse-crushing plant at the shaft ore house so as to add two more sets of rolls and screens and thus supply the mill proper with ore of a finer and more uniform size. A crusher house for preparing the mine samples was built near No. 4 shaft.

At the concentrate-loading plant, two new concrete settling tanks were added, making eight in all. A second 500,000-gal. steel tank for mill water was erected on the hill near the first one. An electrically operated elevator, capable of raising all of the mill tailing 68 ft. was built, and is now in operation. This is of sufficient height to carry the tailing into the second gulch beyond the mill.

A steel, two-story dry or change house, for the underground men was begun on a site close to the collar of No. 4 shaft. It will have locker accommodations for 823 men, and will soon be in commission. The new hospital, under the joint control of the Miami and Inspiration companies, was begun, and will be ready for occupancy about Apr. 1, 1913.

Mining costs remain high on account of the necessity of slicing and square setting on the top of the orebody, so as to prepare it for the proper operation of the shrinkage-stope without undue loss of ore.

La France Truck at Sante Fe Mine

The first La France gasoline-hydraulic truck sold in this country was to the Sante Fe Gold & Copper Mining Co., at San Pedro, N. M. A letter from the superintendent of this company to another mine superintendent contains interesting information concerning the performance of this truck. The letter is quoted by the Hydraulic Truck Sales Co., 1777 Broadway, New York, as follows:

I am in receipt of your favor of January 4, in regard to the service we are receiving from our La France truck. In this connection I would state, that we have our truck in service between our smelter and our coal mine, a distance of approximately 16 miles. We make the round trip, going to the coal mine empty and returning with six tons of coal, in about five hours. On the trip from the coal mine with a load of six tons, we negotiate one grade over 8% which is fully three-quarters of a mile long. The truck takes this grade easily without steaming the water in the radiator. For the last five miles before we reach the smelting plant we have a continuous up grade, and in two or three places the grade is over 20% for short pulls of possibly 50 ft. We have hauled as much as seven tons up this grade and have never yet been stuck. Our gasoline consumption varies between 12 and 13 gal. for a round trip

Corbin Copper Co.

The report of the directors of the Corbin Copper Co., of Montana, for the year ended Dec. 31, 1912, shows that little beside development and location work was performed, which cost about $49,500. Ore extracted from the Bonanza and Rosalie tunnels netted $2820. Eight claims were acquired by location, the lawful discovery work having been done.

The company has decided to exercise its option to purchase the Gambrinus, Belcher and Walsh claims in Butte. The purchase price is $150,000 and the final installment is due in January, 1914. Development, by means of a vertical shaft, will commence immediately.

PHOTOGRAPHS FROM THE FIELD

TRAMMING ON 100-FT. LEVEL OF HOMESTAKE MINE

ON THE 400-FT. LEVEL OF THE HOMESTAKE MINE

(Copyright by W. B. Perkins)

COMPRESSED-AIR LOCOMOTIVES HAULING TRAINS OF 16 CARS AT THE HOMESTAKE

TRANSPORTATION METHODS AT THE HOMESTAKE MINE, LEAD, S. D.

(Copyright by W. B. Perkins)

NEW HERCULES MILL, WALLACE, IDAHO

Photograph supplied by Robert N. Bell, State Inspector of Mines of Idaho.

The Mass Consolidated Copper Co.

The report of the directors of the Mass Consolidated Mining Co., for the year ended Dec. 31, 1912, shows a production of 2,045,006 lb. of copper sold at an average price of 17.0209c., a total of $348,070. The total assets of the company are given at $142,021, and liabilities of $122,683, leaving a balance of assets over liabilities of $9347.

The amount of development work performed during the year was 12 ft. of sinking, 4553 ft. of drifting, 84 ft. of crosscutting, and 243 ft. of raising. The policy of increasing reserve of stoping ground has been continued and the present rate of shipment, amounting to approximately 700 tons per day can be maintained and possibly increased to 1200 tons per day during the present year. The total estimated ore reserve on Dec. 31, 1912, was 726,915 tons.

This mine, in common with many other Michigan mines, has been handicapped by the scarcity of labor during the past year, especially trammers. This was particularly so at those mines situated at a distance from the center of population. The Mass mine, as well as the surrounding properties has been greatly retarded in increasing its production, and at times it has been impossible to keep up its production to operate one head at the mill profitably. There have been no radical changes at the mill. A summary of operations for the year shows rock hoisted, 180,613 tons; rock stamped, 132,891 tons; mineral produced, 2,585,335 lb.; refined copper produced, 2,045,006 lb.; percentage of copper in mineral, 68.502%; refined copper per ton of rock stamped, 15.39%. The cost per pound of refined copper was 14.462c. during the last five months of the year. For the first five months of the year, the cost was 18.308c. per lb., showing a material increase of efficiency during the latter part of the year.

Mine Accidents in New York State

The annual report of the New York Commissioner of Labor for 1912 contains the report of the State Mine Inspector, William W. Jones. This report for the first time gives tables of the death and accident rates in the mines of New York. An examination of the figures is, therefore, of interest. It is found that the fatal accidents in 1912 numbered 13, and since there were employed 2919 men, the death rate was 4.45 per 1000. Of these deaths, 11 took place in iron mines, which show a rate of 6.27; one in a gypsum mine and one in a rock-salt mine. In regard to causes, six were the result of falls of roof, and seven were attributed to hoisting, haulage and mine machinery. It is rather remarkable that no deaths were caused by explosions. Of nonfatal accidents in mines there were 372, corresponding to an accident rate of 127 per 1000. While the death rate of 4.45 is apparently slightly above the average for the country in 1911, given at 4.19 by the U. S. Bureau of Mines, we are of the opinion that it is not so in point of fact. Effort seems to have been made to obtain a true figure for the number of men employed, which is, of course, as essential as the number of deaths, in determining the rate. The uncertainty in this figure renders most tables of death and accident rates only moderately reliable. Probably in most cases the number of men employed is put too high and the rate is consequently too low. In this report the yearly average of men employed was compiled from the monthly average of men employed as given by the various operators. Fatal accidents are considered to be those which resulted in instant death or death before Nov. 12, 1912.

The report is largely devoted to the question of safety and some excellent recommendations are made. The compilation of accident tables and their presentation for the first time, is a step in the right direction. The state mine inspector is deserving of high commendation for this innovation and for the manner in which it has been carried out.

Rare Materials in the Llano-Burnet Region, Texas

There are few, if any, other deposits of rare-earth minerals in the world, and certainly no others in America, outside of the places where monazite is found, that are so extensive as that of Baringer Hill, Tex., which is 12 miles north of Kingsland, 16 miles west of Burnet, and 22 miles northeast of Llano, says the U. S. Geological Survey. It is a low mound, rising about 40 ft. above the river, and is formed by an irregular pipe or short dike of pegmatite that is more resistent to erosion than is the surrounding rock. The most valuable constituent is yttria, for which the deposit is worked by the Nernst Lamp Co. The needs for this mineral are, of course, limited, and but a few hundred pounds per year are extracted, so as soon as enough yttria is obtained to supply the wants of the Nernst company for a few months ahead, the mine is closed. Although the region is more adapted to farming and stock raising than to mining, there are also deposits of building stone, iron ore, gold, graphite, serpentine, talc, sphalerite, lead ore, pyrite, copper ore, manganese ore, and oil found in this region. The building stones alone are of importance at the present time. The occurrence of stream tin and of turquoise in this region has already been noted in the JOURNAL (Mar. 8, 1913).

Tonopah-Belmont

The combined condensed statement of operations of the Tonopah-Belmont Development Co. and the Belmont Milling Co. for the quarter ended Feb. 28, 1913, shows receipts from sales of ore and bullion of $900,117.27, mining, milling and administration expenses, $453,692.94 and a net sum earned of $446,424.33. Miscellaneous income added $17,293.21 to this sum made up a total net income of $463,717.54.

The available resources amounted to $1,188,871.45, which is made up of $284,517.11, due from smelters, $518,799 due from others, $250,000 lent on collateral and $649,163.35 on deposit in banks.

Mineral Production of Tasmania

The mines department of the State of Tasmania gives a note of the mineral production for the year ending Dec. 31, 1912, which includes fine gold, plus the gold contained in blister copper, 37,973.252 oz.; silver-lead ore, 90,123.8 tons; blister copper, 5136 tons; copper and copper ore, 1391.6 tons; tin ore, 3713.8 tons; coal, 53,560 tons; wolfram, 66.4 tons; bismuth, 7.5 tons; osmiridium, 778.77 oz. The total value of £1,493,502 is placed upon this production.

CORRESPONDENCE AND DISCUSSION

Title Difficulty at Rochester

In the JOURNAL of Mar. 15, there appears an article over the signature of H. Wisener Hammond, on the question of titles at Rochester, Nev., that either is a misstatement by one who is obviously uninformed or else was inspired by persons interested in giving a knock to a new camp, which, however, is producing a steadily increasing tonnage and is worthy of consideration by the mining public.

The camp is "located easterly from Oreana" and within the congressional grant limits in which the railroad company can acquire land by selection and patent, that has not been previously located and proved mineral land. However, the greater portion of the present producing area of both Nenzel and Lincoln Hills is within the exterior lines of Sections 16 and 18, T. 28 N, R. 34 E, M. D. M. These sections would not be open for selection by the railroad company even if not mineralized; furthermore, no contiguous sections have been selected, much less an application made for patent, and the only questions of title within the district are of equities, the usual lode-claim conflicts and apex rights. The companies now operating in this district have unquestionable title to their properties and in so far as any railroad grant is concerned, the public is not being misled.

In justice to the earnest operators and legitimate corporations now developing the camp, it is only fair that so erroneous a statement as that made by Mr. Hammond should be corrected.

BEN. R. BINNS.

East Rochester, Nev., Mar. 31, 1913.

Silver Cyanidation at Tonopah—III.

In Mr. Megraw's article, "Silver Cyanidation at Tonopah—III," in the JOURNAL of Mar. 8, 1913, it is suggested that crushing in water might be accomplished without an additional or prohibitive cyanide loss if the pulp were filtered after grinding, introducing it into the cyanide plant at practically the same moisture contained by the residue on discharging. As the amount of water taken into the mill without building up the quantity of solution is governed entirely by the amount of moisture contained in the residue at the time of discharging, and can only be equal to this amount, the water added ahead of cyanidation would preclude the use of water for final wash. It would allow the discharge to go out containing 33% of standard cyanide solution, which is in our case three pounds per ton of ore. When the cost of dewatering with filters is considered together with the mechanical loss of cyanide, and the trouble and expense of again thoroughly mixing a pulp dewatered to such a point of dryness, the additional extraction above 94.44%, the average obtained by the Belmont Milling Co. for the last eight months, it would hardly seem to be an attractive undertaking, even when considering the cyanide which might be saved by crushing in water.

As to the mechanical-stirrer type of agitator being efficient on silver sulphide ore, will state that the type of agitator called the "Butters" was originally installed at our Millers plant and only a fair extraction could be obtained from it until a 6-in. air lift was added, taking pulp from bottom of the vat and discharging it over the top, in addition to the mechanical stirring.

At the Tonopah mill where solution during agitation is kept at 100°, the air for agitation is furnished by a steam-driven compressor and the exhaust steam is used for heating the solutions. As there is only 7% loss between live steam at 125-lb. pressure and exhaust at five pounds, in heating efficiency, we can figure only 7% of cost of producing steam against agitating medium or method, so that if air were not beneficial to extraction, and I am of the opinion that it is, another method or medium could hardly be had at the same or lower cost per ton.

At the Millers plant where live steam is used for heating solution, the cost averages about 18c. per ton, while at the Tonopah plant, with, of course, a better equipment, heating and air for agitation together amount only to 12c. per ton of ore treated.

The benefits to be derived from the heating of solutions used with Tonopah ores, are shown in the following tailing assays from tests made identically, except in temperature. They typify the results obtained in practical mill work.

WARM SOLUTIONS, 100°	COLD SOLUTIONS, 65°
48 hr. 0.015 oz. Au. 2.1 oz. Ag.	0.02 oz. Au. 3.8 oz. Ag.
60 hr. 0.01 oz. Au. 1.4 oz. Ag.	0.02 oz. Au. 3.0 oz. Ag.

I think that Mr. Megraw's assertion that the addition of lead and lime in Tonopah practice is "principally by convenience" is a little broad. In this mill at least, the lime content is very closely watched, it having been proven, not only by laboratory tests, but on a working scale, that extraction is very erratic, due to reprecipitation when either too high or too low alkalinity is carried. The lime is maintained between 1 lb. and 1.5 lb. of CaO per ton of solution.

The amount of lead giving best result is at all times somewhat of a conjecture, but in order that it may not be understood that lead is added at random and that we have some fixed ideas, even though they may be wrong, the practice and theory followed at this plant are here stated.

It is figured that sulphur, alkaline sulphides, and other reducers have a retarding action and are detrimental to the highest dissolving power of the solutions, and in order to keep alkaline sulphides under control, lead acetate is added to precipitate the lead sulphide. The amount used is determined by experimental tests with clean solution. Zinc in solution will act to a great extent, especially in hot solution, the same as lead, forming zinc sulphide, but is not as amenable to the combination as lead. If an excess of lead is present the zinc will tend to accumulate in the solutions, and then the amount of lead is reduced, allowing the zinc to take

care of the alkaline sulphides. In this way a kind of a balance of zinc contents is maintained.

In regard to tube-mill lining, 14 tests, under varying conditions of feed and moisture, conditions in both mills being as nearly identical as possible at all times, showed an average of 5% more product of minus 200-mesh with silex than with the smooth iron liner.

In regard to El Oro lining, which according to Mr. Megraw's Mexican experience is an improvement over all other linings, and which he intimates has never been tried at Tonopah, I think he failed to go thoroughly into what had been tried or considered, and why, in the opinion of the operator, the practice being followed is best suited to their conditions.

The Montana-Tonopah Mining Co. tried El Oro liners, finding their life to be between seven and eight months, while the cost of the lining installed was over twice that of silex. At this plant the cost of silex lining per mill, when lining seven mills, was as follows: Labor at $4.50 per day, $42.25; cement, 28 sacks at $1.035, $28.89; silex, six tons at $42.80, $256.80, or a total of $327.94. To Mar. 20, these mills have been in operation eight months, crushing 13,269 tons per mill, or an average of 55 tons per day with the following average discharge screen analysis: On 100-mesh, 1.33%; on 150-mesh, 5.05%; on 200-mesh, 6.42%; through 200-mesh, 87.20%. This is an average of 36 tests made during eight months.

To this date none of these mills have had to be relined, but it is figured that the first mill will have to be lined in about two weeks and the entire installation during the next 60 days. Allowing eight months, which is very good life for this style of liner, the cost compares more than favorably with any available figures of El Oro liners. "In a Textbook of Rand Metallurgical Practice," Vol. 2, p. 151, the following statement is made: "While the El Oro liner has a longer life than the silex liner, the difference is not great enough to compensate for the extra cost."

In the original plans for our Tonopah mill, rolls were seriously considered by comparison of all data to be had at that time and were only abandoned after an extended visit to Mammoth Copper Co.'s plant at Kennett, Calif., where 27,000 tons of Belmont ore were sampled as custom ore and crushed with rolls. The excessive wear of roll shells and total cost per ton resulting in the eminently conservative installation of stamps. The general manager of one of the late large cyanide mill installations, where rolls are used, told the writer after six months' operation, that he was sorry stamps had not been installed instead of rolls.

A. H. JONES.

Tonopah, Nev., Mar. 18, 1913.

In this letter, Mr. Jones adds some interesting facts to the discussion of cyanide problems and his statements will be accepted as authoritative on Tonopah practice. Except in those instances where he has misinterpreted the meaning of my remarks, we are substantially in accord.

Regarding crushing in water, I agree with Mr. Jones' reasoning. In my article, the matter is referred to in a discussive way and not as a recommendation. Reference to the article in question will show this.

The remarks on agitators and temperature of treatment solutions are interesting additions to the general data on Tonopah practice.

Mr. Jones' objection to my remarks referring to addition of lime and lead acetate is justified by his misinterpretation of the text of my article. "Principally by convenience" referred to the method of addition, not to the quantity of the chemicals used.

Regarding tube-mill lining, it seemed worth while to call attention to the difference between practice at Tonopah and in Mexico. I did not attempt to convey the impression either that the El Oro lining was the best, or that it had not been tried at Tonopah. What I wished to say was that it is not considered the best in Tonopah and is not in use there, although it has been proved by repeated tests to be best suited to conditions in some other districts.

Stamps versus rolls may be the subject of interesting and lengthy discussion. I hope that Mr. Jones may be induced to publish the facts and figures which led to the decision in favor of stamps at the Belmont mill. Some others have adopted rolls and do not announce any regret.

H. A. MEGRAW.

New York, Mar. 24, 1913.

Pitot Tube in Gas Measurement

After reading Professor McQuigg's interesting article on the "Pitot Tube in Gas Measurement," in the JOURNAL of Mar. 29, 1913, it occurs to me that unless someone makes remarks similar to the following, many persons may be misled by the concluding part of the article.

When a given volume of gas is named, it is understood to mean the volume at standard or ordinary temperature and pressure unless the contrary is distinctly stated. When, therefore, Professor McQuigg figures out "the volume of gases" as "47,857 cu.ft. per minute," the natural inference would be that this is the volume at ordinary temperature. It is, however, the volume measured at the static pressure and at the temperature prevailing in the tube, 645° F., and, therefore, represents only 22,800 cu.ft. at, say 67° F., without correcting for the slight difference in pressure.

The article hardly gives sufficiently accurate directions for obtaining the average head over the whole flue, nor satisfactory instrumental means for eliminating the suction caused by velocity energy on the static head. Without very careful attention to these points, the pitot tube, as shown, may lead to results sometimes too low but often far too high, even to double the correct value.

JOSEPH W. RICHARDS.

South Bethlehem, Penn., Mar. 30, 1913.

A Plea for Cost Details

I should like to address to the writers of descriptive articles on cyanide practice, a plea for the inclusion of supplementary figures in regard to precipitation, showing the quantity of zinc consumed per ounce of fine gold and silver precipitated, as also the cost per fine ounce for precipitating and refining.

These, expressed in terms per ton of ore, are, of course, necessary for the mine bookkeeping, but are valueless as a basis for metallurgical comparisons, which latter is presumably the object in view in writing the articles.

E. M. HAMILTON.

Cobalt, Ont., Apr. 2, 1913.

EDITORIALS

The Proposed New Tariff

The proposed new tariff bill introduced in Congress on Apr. 7, makes material reductions in the rates of duties on nearly all of the ores and metals. Confining our attention to those things in which the mining industry is especially interested, iron ore is put on the free list, while pig iron is to pay 8% *ad valorem* and steel ingots 10%. Lead ore is to pay 0.5c. per lb. and pig lead and lead bullion 25% *ad valorem*. The duty on zinc ore is to be 10% *ad valorem* and on spelter 10%. Quicksilver, nickel, antimony and antimony ore are each to be 10% *ad valorem*. Aluminum is to be 25% *ad valorem*.

The wisdom of levying *ad valorem* rates on the metals and ores, especially the latter, is doubtful. It has both advantages and disadvantages. Thus, in the case of zinc ore there will no longer be any liability to pay duty on the zinc contents of copper and lead ores. On the other hand, smelters who import ores on sliding-scale contracts will experience more or less difficulty in determining the value of the ore at the time of its passage through the customs. The amount of the duty on zinc ore will vary greatly according to the port of entry. Thus, ore originating in British Columbia, destined to Oklahoma, and subject to a high freight rate, has no great value at the border, and consequently will have to pay but a small duty. On the other hand, an ore coming through on a low freight rate will have to pay a relatively large duty.

The provisions relating to smelting in bond appear at first sight to eliminate some present difficulties. It is provided that the bonds on ore smelting may be liquidated by the exportation or entry of the metals obtained. According to this, the zinc smelter who imports ore containing lead will apparently be required to pay duty only on the lead that he recovers from the ore. Such a provision is, of course, merely common sense. In order to make things entirely clear, however, to avoid arbitrary rulings by the Treasury officials, and to avoid litigation, the provision appended to the articles relating to antimony ore and lead ore [Articles 148 and 156] ought to be stricken out.

The present duties on lead and spelter are 2⅜c. and 1⅜c. per lb., respectively. Assuming average prices for these metals, the new duties will correspond to about 1@1¼c. per lb. for lead and ½@⅝c. per lb. for spelter.

The removal of the duty on iron ore is too small a matter to have any adverse effect upon the iron-mining industry of the Lake Superior region. As J. R. Finlay pointed out in a recent paper on the valuation of iron mines, presented to the American Institute of Mining Engineers, the position of the Lake Superior iron mines is too secure, both on account of geographic and economic reasons, to put them in any danger from the competition of foreign ore, duty or no duty. Those mines are protected by geography.

The reduction of the duties on lead and spelter ought to have a steadying effect upon the prices for those metals. The zinc industry can, no doubt, stand the reduction. There is likely to be a little more disturbance in the lead-mining business, but nowhere near so much, we think, as many persons anticipate. We doubt if any of the dreadful things that have been prophesied will in fact come to pass. We do not believe that the forthcoming reductions will do any immediate harm to the mining industry in any important particular. In the end they will probably be found to have done good.

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Accidents in Metal Mines of the United States

The U. S. Bureau of Mines has given us, through the investigations of Albert H. Fay, mining engineer on its staff, a complete report of the accidents in the metal mines of this country. Previously the only summarized information upon this subject has been the compilations of Frederick L. Hoffman, which have been published in the JOURNAL. The data available to Mr. Hoffman were incomplete, and his conclusions were necessarily indefinite. Averaging the data for all the states and for all the years for which information was available, he arrived at the figure of 3.09 per thousand as the fatality rate in metal mining in the United States, which compared with 3.13 per thousand for the coal mines during about the corresponding period of time. Mr. Hoffman remarked that it was probable that if the subject were thoroughly investigated, it would be shown that the fatal accident liability is really greater in metal mining than in coal mining. The Committee on the Prevention of Mine Accidents, commenting upon Mr. Hoffman's report, remarked: "Bearing in mind the conditions that we have mentioned above, and the fact that the statistics for coal mining are far more complete than for metal mining, we surmise that the loss of life in metal mining in the United States is actually larger, proportionately, than in coal mining." Mr. Fay has now confirmed that surmise.

Mr. Fay found that in 1911, out of 165,979 men employed in the metal and non-metal mines, excepting coal, 695 were killed, representing a rate of 4.19 per 1000 men employed, as compared with 3.73 per 1000 for the coal mines of the country during the same period.

The statistics for 1911 are in line with the well established fact, viz., that the largest number of fatal accidents are due to falls of ground, while next in order come falls in shafts, stopes, etc., and the misuse of explosives. The terrible danger from fire in mines is shown by the fact that 5.32% of the fatalities in 1911 were due to mine fires.

The extraordinary hazard of metal mining is more fully shown by Mr. Fay in his report of serious and slight accidents. While about four men out of every thousand employed were killed, 25 were seriously injured and 135 suffered slight injuries. In the matter of serious and slight injuries, the percentage resulting from falls of ground was about the same as in the case of the fatal

accidents; but aside from that common cause, accidents resulting from machinery and from the car and haulage systems replace the fatal accidents resulting from falls and from the misuse of explosives. Of course, this difference is natural. If a man falls down a shaft or drills into a missed hole he is usually killed, not merely hurt.

The grouping of Mr. Fay's figures according to class of mines exhibits some rather surprising facts. The fatality rate among the copper mines was 5.33 per 1000 men employed; among the iron mines it was 4.29; among the lead and zinc mines of the Mississippi Valley it was only 3.43. The copper and iron mines, speaking generally, are worked on a large scale, with the most modern equipment, and under the highest class of supervision. The lead and zinc mines, on the other hand, are to a considerable extent operated in a rather picayune way. It would not be unnatural to look for the fatality ratios to be just the opposite of what Mr. Fay's statistics show. A possible explanation is that the records are less complete in the case of the land and zinc mines than in that of the copper and iron mines. Anyway, it is undoubtedly the case, we think, that no accident statistics are sufficiently precise to warrant any deductions from small differences ever to be drawn.

The total number of fatalities can be determined precisely without any great difficulty, but we are unaware of any system existing in this country which enables the number of men employed to be determined properly. In many of the states, as in Montana, it is simply guessed that a certain number of men, say 10,000, is employed. In the State of New York, the inspector secures from all the mine operators a statement giving the average number of men employed monthly during the year, and from these monthly averages computes an annual average.

There is always a difference, however, between the number of men employed and the number of men who work. Almost every mine has on its payroll a larger number of men than the average number at work; in other words, a larger number than would be found by dividing the total amount of the payroll by the product of the number of days of working and the average daily wage. In computing the accident statistics, the divisor is doubtless too high always, and the quotient correspondingly too low. Certainly the statistics do not make things out any better than they are. However, the exhibition of four men killed and 160 injured, seriously or slightly, out of every 1000 men employed in the metal mines of the United States every year, is sufficiently disgraceful.

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The Copper Statistics for March

The refiners' statistics for March were satisfactory in their showing of a reduction of upward of 18,000,000 lb. in their stocks, to which, of course, a very large exportation of copper contributed largely. The reasons leading to such an exportation are well known and nobody is misled by an exaggerated figure in that particular. The especially encouraging feature of the March statistics is the very large domestic delivery and the indication that American consumption is maintaining itself excellently, although the total of deliveries in the first quarter of 1913 is a little less than in the last quarter of 1912.

It is noteworthy also that in spite of all of our talk and suspicion about a relaxation of business in Europe we exported to there about 40,000,000 lb. more of copper in the first quarter of 1913 than in the last quarter of 1912, and during this quarter—the first of 1913—exports exceeded domestic deliveries. It is possible that we have been fixing too much attention on Germany, forgetting that Great Britain, France and other countries also consume copper.

The refiners' production in March came down to the present rate of the smelters. In that particular the showing of the month was quite normal.

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The Easy Turning Stoper

The ease with which a hammer drill can be rotated by hand is chiefly dependent on the amount of jiggle or "kick" which it shows in operation. The degree of this kick is mainly determined by the ratio of the air-feed piston diameter to the hammer diameter. This must be small or the drill will be pressed hard and continuously against the rock and will be exceedingly difficult to turn.

The advantage of an easy-turning machine from the miner's point of view is evident. The advantage to the company is just as real. There is a point in drilling flat holes where so much time is lost in changing steel, that the stoper loses its advantage over the piston type. The hole does not clear itself of cuttings, the drill is wedged in, and it may easily happen that more time and much more labor are expended in getting the steel out of the rock than in getting it in.

In rotating the drill, the flute of the steel on the bottom of the hole moves the cuttings back and forth; for each swing a certain amount of motion of the cuttings toward the collar takes place, and a little driblet of dust drops from the hole. If the number of rotations is greater, more cuttings are removed, the hole is kept cleaner and the steel is easier to extract. If the machine rotates with difficulty the miner will rotate it slowly. If it rotates easily, he will rotate it frequently, and by wasting less time extracting the steel, will drill a greater footage per shift. Incidentally the jiggle of the steel in the hole helps to keep the cuttings moving down freely and the miner also works more energetically in all respects if not exhausted by wrestling with a stuck drill.

An air drill is rather a tool than a machine. It is a greater consumer of manpower than of mechanical power. Ease and convenience are of greater importance than mechanical efficiency, and good management gets a maximum output from the workman by providing him with a maximum amount of this ease and convenience.

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The strike at the Rio Tinto mine, in Spain, the reported closing down of the Mt. Lyell mine, in Tasmania, and the cessation of smelting at Cananea, will temporarily reduce the production of copper rather materially. However, it is now reported that the Rio Tinto strike has been settled. The closing of the Cananea smeltery checks not only the production of copper from the Cananea mines, but also from the Miami mine, in Arizona. The trouble with the Cananea works is the burning of bridges faster than the railway can rebuild them, wherefore the railway has temporarily gone out of the transportation business.

BY THE WAY

It is reported from Monterey that the smelters have been turning out bullion in large bars; too heavy to be carried away in the event of the capture of the city by rebels.

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The brokers who flim-flam Comstock mining shares in the San Francisco stock exchange consider it desirable to have a "Daddy" of the market. When times are dull they will talk about the necessity of getting a "Daddy." A "Daddy" is a Father Bountiful, a person with cash, who is fooled into the idea that he is playing the game from the inside but in the end finds himself hooked. He is analogous to the "Angel" of the theatrical profession.

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Hoover's "Agricola" commands general praise. "It was a fine thing to do and it was well done" is the universal verdict. In this connection it is interesting to tell that many years ago, E. P. Mathewson and H. V. Winchell conceived the idea of making a translation of "Agricola" and several chapters were translated under their supervision and with their assistance. Then something interfered with the plan and it was dropped. "This was fortunate," says Mr. Winchell, "because the way was left clear for Hoover, who has made a much better job of it."

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In order to stop the alleged theft of gold by laborers in the gold mines in the Cripple Creek district of Colorado, three big companies, operating mines there, are seeking to get the Supreme Court to review the action of the Eighth United States Circuit Court of Appeals in refusing to restrict the business of assayers in the vicinity in small purchases of gold, says the *Evening Post*. Senator Thomas heads a corps of attorneys which has presented the matter to the Supreme Court. They state that hundreds of thousands of dollars worth of high-grade ore are lost by the mine owners annually in this way. It is charged that the 48 persons sought to be enjoined are engaged in no other business than buying and selling ores stolen by workmen and others. Edward C. Stimson and James J. Banks have filed papers in opposition to the review, hoping that the decision in their favor by the lower court will be allowed to stand. They denounce the movement of the mine owners as an attempt at "government by injunction."

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The U. S. Civil Service Commission announces an open competitive examination for electro-metallurgist, for men only, on May 7, 1913, to fill a position in the Bureau of Mines at a salary from $1500 to $1800 per year. The duties of this position will be to conduct investigations and inquiries into metal and metallurgical problems, and especially the investigation of ores with reference to the feasibility of their treatment by electro-metallurgical processes. Competitors will be examined in: Practical questions in electro-metallurgy, 40; general education and scientific training, 30; professional experience and fitness, 30. An educational training equivalent to graduation from a college or university of recognized standing, such training to include courses in geology, chemistry, physics and metallurgy, and actual experience in electric-furnace work, are prerequisites for consideration for this position. Applicants possessing a thorough knowledge of metal mining and metallurgical work, including smelting operations, will receive additional credit under subject 3. Applicants must have reached their twenty-fifth but not their fortieth birthday on the date of the examination. Persons who meet the requirements and desire this examination should at once apply to the United States Civil Service Commission, Washington, D. C., for application and examination Form 1312 for electro-metallurgist (male).

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The United States Civil Service Commission announces an open competitive examination for architectural and structural-steel draftsman, for men only, on May 7 and 8, 1913, to fill a position in the Lighthouse Service, at a maximum salary of $1500 per year. Competitors will be examined in: Mathematics, pure and applied, 20; topographical and hydrographical surveying, 15; general building and steel construction and drawing, 40; training, experience and fitness, 25. Two days will be required for this examination. Five years' experience in engineering work or drafting is a prerequisite to eligibility for appointment from this examination; of these five years a technical-school training will be considered equivalent to three years. Age, 22 years or over on the date of the examination. Persons who meet the requirements and desire this examination should at once apply to the United States Civil Service Commission, Washington, D. C., for application and examination Form 1312 for architectural and structural-steel draftsman (male).

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George Labram, who was killed during the siege of Kimberley, after he had achieved immortality as the builder of "Long Cecil" out of raw material, was once master mechanic of the Anaconda company, at Butte. This was in the early days of Butte. "Who is that new feller down in the shops?" asked Mr. Daly of the superintendent, "He's a mighty good man. Let him ter mechanic," replied the "supe." "He ain't no good," remarked Mr. Daly. "He's all right," retorted the supterintendent, "He's a mighty good man. Let him alone." "Well," said Mr. Daly, "he may be as you say, but he's just told me he's going to save us 40% in power. The feller before him said that and the feller before him said the same. That's 120% and I don't see it."

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W. L. Saunders, president of the Ingersoll-Rand company, was put in charge of the Bedloe Island channel soon after his graduation from the University of Pennsylvania. This was in 1880. In connection with this work he had some rock excavation to do. Contractors' bids ranged from $1 to $40 per yard. The remarkable variation convinced him that they did not know about such work and would be unsafe to rely upon. Rock-drilling was not then the well known art it is now. So Saunders decided to do the job himself on the theory that he knew as much about it as any of the would-be contractors and could more surely learn what he didn't know. He bought four Ingersoll-Rand drills and went to work. This led to an acquaintance with the Ingersoll company and before long an association with it, which has continued ever since then. The company then had five officers and employed 60 men. Now it has 260 officers and 4000 men.

American Electrochemical Society

The 23d general meeting of the Electrochemical Society took place in the Hotel Traymore, at Atlantic City, N. J., on Apr. 3-5, there being a very good attendance. On Thursday morning at the annual business meeting of the Society the report of the board of directors was read and an announcement of the annual election was made. Dr. E. F. Roeber was elected president of the society for the ensuing year. In the afternoon session the following papers were read:

"Conduction and Radiation of Heat," I. Langmuir.
"Experiments with Furnace Electrodes," F. A. J. Fitzgerald and A. T. Hinckley.
"Aluminum Nitride," J. W. Richards.
"Some Tests of the Edison Storage Battery," C. W. Bennett and H. N. Gilbert.
"Concentration Cells Containing Organic Liquids Immiscible with Water," R. Beutner.
"Concentration Changes in Copper Sulphate Electrolysis," C. W. Bennett and C. O. Brown.
"The Three-Phase-Two-Phase Induction Furnace," A. E. Greene.

On Friday an excursion was made to Philadelphia, where the works of the Crucible Steel Casting Co. were visited and the making of crucible steel in a 2-ton Roechling-Rodenhauser induction furnace was witnessed. In the afternoon the chemical works of Harrison Bros. & Co. and the gas works of the United Gas Co. were visited. In the evening Prof. Frank B. Kenrick, of Toronto, delivered an address on "Hyperbasis."

On Saturday, the retiring president, W. Lash Miller, delivered his presidential address and the following papers were then read:

"Electrodeposition of Gold and Silver," Francis C. Frary.
"Electrodeposition of Copper," C. W. Bennett.
"Electrodeposition of Brass and Bronze," C. W. Bennett.
"Electrodeposition of Cobalt and Nickel," O. P. Watts.
"Electrodeposition of Lead," F. C. Mathers.
"Solid, Thick Lead Cathodes From Lead Acetate Solutions," F. C. Mathers.
"Solid, Thick Lead Cathodes From Lead Lactate Solutions," F. C. Mathers and B. W. Cockrum.

The meeting was a successful affair as is always the case with this wide-awake society.

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Interstate Commerce Decisions

WASHINGTON CORRESPONDENCE

The Interstate Commerce Commission has made an order in the case of American Wire & Cable Co. versus Chicago & Northwestern Ry. Co., in which it holds that the varying rate on copper wire according as navigation is or is not open on the Great Lakes is permissible, while it also allows a rate of 22c. per 100 lb. from Dollar Bay, Mich., to Chicago, Ill., as reasonable. The rate in summer is 15c. The Commission holds: "We are of opinion and find that defendants' method of applying a higher rate on copper wire during the months when Lake navigation is closed than that applied when competition by Lake-carrying vessels is in force is not in itself unlawful. As we are unable to find from the evidence that the 22c. rate is unreasonable, it follows that the complaint must be dismissed."

RATES ON TENNESSEE PHOSPHATE

The Interstate Commerce Commission has issued an order in the case of Federal Chemical Co. and others versus Louisville & Nashville R.R. Co., in which it cancels the proposed advanced rates on phosphate rock going from Tennessee to New England points and orders present rates maintained for two years. It also orders the carriers not to discriminate between phosphate rock in bulk and ground phosphate in bags. The Commission says in part: "No transportation reason is given why the rates on ground phosphate rock in bulk and ground phosphate rock in bags should differ. The same equipment is used to convey both, and there is less liability to leakage and loss when the phosphate rock is carried in bags. This distinction seems to be entirely artificial and without precedent. The record shows no sufficient justification for an increase in these rates, and an order will be issued that as to rates suspended the carriers have failed to justify the same and that rates no higher than the present rates should be maintained as maxima for two years."

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Dynamite Grade Markings

F. H. GUNSOLUS*

The meaning of the grade distinctions or "percentage strength" mark on dynamite is somewhat of a puzzle to many consumers, and often a source of misunderstanding between manufacturer and customer. Originally a 40% dynamite meant that the dynamite contained 40% actual nitroglycerin by weight, but as modern dynamites do not always contain the proportion marked, a short description of modern practice of grading may be of interest. A slight knowledge of the history of the manufacture of high explosives may also help to explain the situation.

FIRST DYNAMITE MADE OF NITROGLYCERIN AND INFUSORIAL EARTH

The dynamite first manufactured by Alfred Nobel on a large scale was called "No. 1 Dynamite," and consisted of 75 parts by weight of nitroglycerin and 25 parts by weight of "kieselguhr," an inert infusorial earth, consisting of microscopic tubes and shells, which has the property of absorbing three or four times its weight of nitroglycerin. This was truly a 75% nitroglycerin dynamite, but it was not so strong as the 40% strength dynamites made today, which contain even less than 40 parts in a 100 by weight of actual nitroglycerin. The kieselguhr acts only as an absorbent. It does not assist in the explosion and permits making only one grade of dynamite, that in which the kieselguhr holds nearly all the nitroglycerin it can. If more nitroglycerin is added, the dynamite leaks nitroglycerin to a dangerous extent, and if less nitroglycerin than 75% is used the dynamite becomes insensitive, so that a mixture of 40% of nitroglycerin and 60% of kieselguhr cannot be detonated. This property is taken advantage of in the transportation of nitroglycerin for medicinal purposes. The kieselguhr is chemically inert. A pound of 75% kieselguhr dynamite does exactly as much work and no more than three-fourths of a pound of pure nitroglycerin.

The dynamites in present use in the United States were originally known as "active-base" dynamites in contradistinction to the kieselguhr dynamites which had an inert base. The active-base dynamites at first substituted a crude gunpowder for the kieselguhr, but as this was a poor absorbent, it was not possible to make a dynamite

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containing more than 30% or 40% of nitroglycerin; so a mixture of wood meal and nitrate of soda was used instead of gunpowder. Using these two ingredients, dynamites with a nitroglycerin content ranging from 20% to 75% could be made, worked, packed and exploded.

Furthermore, with an active base like wood meal and nitrate of soda a dynamite having only 40% nitroglycerin will develop as much power or more than a 75% kieselguhr dynamite. A definite proportion of wood meal to nitrate of soda makes an explosive not too wet to leak nor yet too dry to be punched into the paper shells. More wood meal and less nitrate are used in dynamite with more nitroglycerin, and more nitrate and less wood meal, or wood meal of less absorbing capacity like fine-grained sawdust, are used in the dynamites containing less nitroglycerin. Using these three ingredients with minute proportions of other nonexplosive substances required to stabilize the dynamite, a type of high explosives known as "straight dynamites" was made which constitutes the standard of strength against which all other dynamites are graded.

The Addition of Other Explosive Substances Increases the Strength

Other explosive substances incorporated into dynamite increase its power over straight dynamite and it is necessary to reduce the amount of nitroglycerin and otherwise modify the formula so that the new compound develops the same power in actual work as the standard dynamite. For instance, guncotton dissolved in nitroglycerin makes a sticky, jelly-like substance which, added to the wood meal and nitrate of soda, makes an explosive much more powerful than one in which nitroglycerin alone is used. Such an explosive graded on its actual content of nitroglycerin would be so much more powerful than the same grade of straight dynamite as to be unsafe and unsatisfactory in work where the blasters were accustomed to using the standard grade.

Many explosives in the market now containing no nitroglycerin at all are equal to a 40% straight nitroglycerin dynamite, and these are graded as described on the basis of strength developed, not on the nitroglycerin content. Other powerful explosives widely used contain only small amounts of nitroglycerin—from 5% to 10% sometimes—which, nevertheless, develop as much power, weight for weight, as 50% and 60% straight nitroglycerin dynamites. It is readily seen, therefore, that a customer should not feel that he has been injured when he finds that the dynamite he has been buying as 40% strength has actually less than 40% nitroglycerin in it. While the straight nitroglycerin dynamites are still on the market, they are the only ones that actually contain the same percentage of nitroglycerin as the percentage strength marked. In many ways they are distinctly inferior, being too quick for a good deal of work and much more sensitive to rough handling.

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North Lake Mining Co.

The report of the North Lake Mining Co., for the year ended Dec. 31, 1912, shows a total mine expense of $29,704. Due to the failure of Stephen R. Dow, former president of the company, a loss of $160,188 was sustained. This sum represented the amount with interest that should have been in the treasury at that time. The assignee of Mr. Dow reports practically no assets. To meet expenses from Aug. 1 to Dec. 31, 1912, $19,000 was borrowed, and this amount is being increased at the rate of approximately $5000 per month.

Work is being pushed on the shaft, and as soon as this has reached a sufficient depth, a crosscut will be driven to the northwest and also one to the southeast to explore lodes which have been discovered by diamond drilling.

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American Smelting & Refining Co.

At the annual meeting of this company, Edward Brush, vice-president, said, as reported by the *Boston News Bureau,* that it is the policy of the company to purchase and own mines in Mexico but not in the United States. As result of development of its Mexican mines and in spite of revolutionary disturbances, earnings from its Mexican mining properties in 1912 were the largest in the company's history, due to larger tonnage and better metal prices.

The chief difficulty in Mexico last year was interruption of traffic. This resulted in frequent shortage of fuel and lack of cars to haul out bullion. In case of the smelting works, stocks accumulated at times, but it was possible to bring up the average by utilizing excess capacities when traffic was opened again. At present the Matahuela and Velardena works are closed because of shortage of coke. If all shipments due up to end of the year had been made in time to appear in the annual statement, the Mexican properties would have reported earnings about $1,000,000 larger.

In instancing difficulties encountered, Mr. Brush mentioned the case of a general manager whom the rebels lined up against a wall and threatened to shoot, and another superintendent locked in a mine three days. All Mexican employees were notified last year that they were not permitted to risk their lives in the company's employ, and that it did not insist on anyone remaining in the country who desired to leave. No one left, and the company rewarded those in danger spots by a 20% bonus at the end of the year instead of the usual 10 per cent.

The company will continue its expansion policy. Plants at Chihuahua, El Paso and Tacoma will be increased and other improvements made. Construction and improvements in 1913 will call for at least $2,000,000, all of which will be charged directly to earnings.

Mr. Brush said that the report that the government is preparing suit against the company is unfounded. "I cannot say what the attorney-general may do," he said, "but so far no action has been taken along that line nor do we look for any. When District Attorney Wise investigated the company's affairs on grounds that it was conspiring to maintain prices by decreasing production, he found the contrary true and that we had increased production rather than curtailed it. There is no monopoly of the smelting business. The only member of Congress who labored to bring suit by the government failed to receive the backing of the mine owners of Colorado and is no longer a member of Congress."

Those closest to the American Smelting & Refining Co. and American Smelters Securities Co. believe that the most that a dissolution suit by the government could accomplish would be segregation of these two companies. American Smelting & Refining now owns all common stock of Securities company, and, therefore, is entitled to all earnings above charges and preferred dividends.

PERSONALS

A. W. Newberry is in New York.

Robert Linton has returned to Pittsburgh from New York.

H. H. Knox has returned from Norway. He expects to go to Parral, Mexico, in about a fortnight.

L. Maurice Cockerell has arrived in New York from Brazil and is returning to Chihuahua, Mexico.

William Wraith, general manager of the Tooele Smelting Works in Utah is visiting New York.

J. R. Finlay has returned from Southeastern Missouri and has been lecturing at Harvard this week.

A. L. Jones has accepted a position with the Mines Co. of America at the Creston Colorado mine, Sonora, Mexico.

Richard H. Vail, assistant editor of the "Journal" has gone to the West, especially to visit the copper smelting works.

Louis A. Wright was married on Apr. 2 at Newburgh, N. Y., to Miss Ella Birdsall. Mr. and Mrs. Wright will reside in El Paso, Texas.

Simon Guggenheim has been chosen an additional member of the board of directors of the American Smelting & Refining Co., and has been appointed a member of the executive committee.

Leslie H. Webb, Secretary of the Wedge Mechanical Furnace Co., of Philadelphia, has just returned from a two-months trip to the Pacific Coast, and reports satisfactory progress in the introduction of the Wedge furnace.

Charles M. Schwab has been made chairman of the board of the Bethlehem Steel Co., remaining president of the Bethlehem Steel Corporation. Eugene G. Grace, for some time past general manager, succeeds Mr. Schwab as president of the Bethlehem Steel Co. Other changes have been made necessary by the large increase in the business of the company. Archibald Johnson has been made first vice-president of the Bethlehem Steel Corporation, assuming the duties of this office, in addition to those of vice-president of the Bethlehem Steel Co. H. S. Snyder, second vice-president of the Bethlehem Steel Corporation, and vice-president of the Bethlehem Steel Co., will be in charge of the subsidiary companies of the corporation, as well as the development of the steamship company to transport iron ore from the company's newly acquired properties in Chile. His duties will include general supervision over the operations of the Titusville Forge Co., recently purchased by the company. C. A. Buck, who has been associated with the company as metallurgical engineer, has been made a vice-president of the Bethlehem Steel Co. Mr. Buck will have charge of the company's mines in Chile, as well as other technical matters pertaining to the development of the company.

OBITUARY

Harvey Sprague died at Hollis, N. Y., April 6, aged 42 years. He was a mining promoter and engineer of Vancouver, B. C., and was visiting the East on business.

Milo P. Ward died at his home in Portland, Oregon, March 27, aged 58 years. He was well known in Oregon and the West as a mining promoter and owned valuable mines in the Gold Hill district of Jackson County, Oregon. He was born in Pulaski County, Indiana, and in 1887 went west to Oregon, where he has since been interested in mining.

SOCIETIES

University of Pittsburgh—At Pittsburgh recently Andrew W. and Richard B. Mellon, bankers and also interested in large manufacturing enterprises, announced a gift of $450,000 to the University of Pittsburgh to establish the Institute of Industrial Research and School of Specific Industries. The new school will be the first of its kind in the United States and will be under the direction of Dr. Robert Kennedy Duncan.

Faraday Society—The sixty-seventh general meeting of the Faraday Society, in London, Mar. 12, 1913, was devoted to a general discussion of colloids and their viscosity. Professors Victor Henri, Wolfgang Pauli, H. Freundlich and Wolfgang Ostwald came from the Continent especially for this meeting. Of interest to the metallurgical physical chemist were Henri's paper on the measurement of the size of colloidal particles, and Freundlich and Ishazake's "On the Rate of Coagulation of $Al(OH)_3$ sols as measured by the Viscosity Change."

INDUSTRIAL NEWS

The Ingersoll-Rand Co. reports net earnings of $2,022,251 in 1912 as against $1,008,988 in 1911. After paying interest of $100,000 on bonds and dividends of $151,518 on the preferred stock, there remained a surplus of $1,765,733 compared to $752,470 at the end of the previous year. The plants of the company were reported to be working at 95% capacity. Two new plants are under construction to enable the company to take care of its rapidly increasing business.

Dr. L. D. Ricketts is having a 10-ft. Hardinge pebble mill built. The design is noteworthy, not only because of the large diameter of the mill, but also because it calls for construction of cast steel in two sections. The standard Hardinge pebble mill is made up of nine ⅜-in. steel plates, lap riveted, with cast-steel or cast-iron trunnions. Based on the comparative performance of the 6 and 8-ft. Hardinge mills, it is believed that the 10-ft. mill will have double the crushing capacity of the 8-ft. mill.

NEW PATENTS

United States patent specifications may be obtained from "The Engineering and Mining Journal" at 25c. each. British patents are supplied at 40c. each.

TITANIUM—Method of Treating Metals. Auguste J. Rossi and William F. Meredith, Niagara Falls, N. Y., assignors to the Titanium Alloy Manufacturing Co., New York, N. Y. (U. S. No. 1,056,125; Mar. 18, 1913.)

DRILL CHUCK. Frederick Wiard, Detroit, Mich. (U. S. No. 1,056,076; Mar. 18, 1913.)

DRILL SHARPENER, Shaper and Gager. John Christen Thoen, Burke, Ida. (U. S. No. 1,056,856; Mar. 25, 1913.)

DRILLS—Stroke-Shortening Device for Percussive Tools. Charles C. Hansen, Easton, Penn., assignor to Ingersoll-Rand Co., New York, N. Y. (U. S. No. 1,056,170; Mar. 18, 1913.)

DRILLS—Valve for Percussive Tools. Lewis C. Bayles, Easton, Penn., assignor to Ingersoll-Rand Co., New York, N. Y. (U. S. Nos. 1,052,250 and 1,056,251; Mar. 18, 1913.)

STEAM-SHOVEL MECHANISM. Charles F. Hinkley, Mount Iron, Minn. (U. S. No. 1,056,676; Mar. 18, 1913.)

CONCENTRATING TABLE. Guy H. Elmore, Swarthmore, Penn. (U. S. No. 1,056,519; Mar. 18, 1913.)

SEPARATION BY FLOTATION—Apparatus for Separating Minerals. Alexander Herbert Smith, Glasgow, Scotland. (U. S. No. 1,056,952; Mar. 25, 1913.)

LEAD AND SILVER RECOVERY, Method of. Theodore G. Timby, Chicago, Ill. (U. S. No. 1,056,383; Mar. 18, 1913.)

FUSING AND PURIFYING COPPER—Process of Fusing and Purifying Metals. Walter S. Rockey and Hilliary Eldridge, New York, N. Y., assignors to Metallurgical Research Co. (U. S. No. 1,057,882; Apr. 1, 1913.)

ORE TREATMENT—Treatment of Copper Ores Bearing Precious Metals by Cyanide. John Collins Clancy, New York, N. Y., assignor to Clancy Metals Process Co., New York, N. Y. (U. S. No. 1,057,936; Apr. 1, 1913.)

FILTER for Slimes. George J. Young, Reno, Nev. (U. S. No. 1,057,475; Apr. 1, 1913.)

DESULPHURIZING—Process of Desulphurizing Ores and Metals. Albert E. Greene, Chicago, Ill., assignor to American Electric Smelting & Engineering Co., St. Louis, Mo. (U. S. No. 1,056,900; Mar. 25, 1913.)

FERROCHROMIUM—Process of Treating Crude Ferrochromium and Producing Solid Ingots. James Turner Morehead, New York, N. Y., and John B. Huffard, Ferris, W. Va., assignors to Electro Metallurgical Co., Chicago, Ill. (U. S. No. 1,057,078; Mar. 25, 1913.)

COBALT—Electrolytic Process for Recovering Metallic Cobalt from a Solution of Its Sulphate. Chas. J. Reed, Philadelphia, Penn. (U. S. No. 1,055,653; Mar. 11, 1913.)

ZINC—Improvements in the Method of Manufacture of Zinc from Poor Zinc Ore and Tailings. F. C. Beauchamp, London, Eng. (Brit. No. 17,648 of 1911.)

ZINC—Improvements Relating to a Preliminary Heater in Connection with Furnaces for the Reduction of Zinc Ores. C. Roitzheim, Coln, Germany. (Brit. No. 1338 of 1912.)

ZINC—Production of Zinc and the Like. Antoine Bonaventure Pescatore, London, England. (U. S. No. 1,057,878; Apr. 1, 1913.)

DRILL—Hammer Drill. William Prellwitz, Easton, Penn., assignor to Ingersoll-Rand Co., New York, N. Y. (U. S. No. 1,057,169; Mar. 25, 1913.)

EDITORIAL CORRESPONDENCE

SAN FRANCISCO—Apr. 3

Approval of the Appropriation for the State Mining Bureau as asked for by F. McN. Hamilton, state mineralogist, has been recommended to the legislature by the legislative committee of the California Miners Association. Mr. Hamilton's estimate is $9000 greater than the estimate made by his predecessor, W. H. Storms, whose estimate was turned down by the State Board of Control. Mr. Hamilton asks for $119,000, to be disbursed as follows: Salary, $6000; general support of bureau, $50,000; general report, $40,000; report on ancient channels, $10,000; report on iron deposits, $3000; printing, $10,000. Mr. Storm's estimate covered the same items and the additional items of special work in the Mother Lode region, metallurgy and mining methods, and the total asked for this work was $110,000. In commenting on the estimate of Mr. Storms it was said in the "Journal" of Dec. 14, 1912, that the estimates for field work were so low that it would be necessary to practice every economy in order to complete the work to the satisfaction of the state mineralogist and to the best interests of the state. The California Miners Association would have made the same recommendation on behalf of Mr. Storms had he retained the office. The State Mining Bureau will, in all likelihood, get the full amount of the appropriation asked. While it is regrettable that three important items are omitted from the plans of Mr. Hamilton, he is to be commended for his courage in placing the estimates for the work that is proposed at figures that will insure prompt and effective results.

The Legislative Bill to Restrict Gold Dredging and conserve the soil for agriculture may be modified to exempt the dredging lands now operated or owned by dredge operators. The proponents of the bill hope to pass it in some form, for they seem to be greatly in need of the farmer vote. The opponents hope to prevent its passage or at least to so amend it that it can do no great harm to the gold dredging industry of the present generation. Various chambers of commerce and boards of county supervisors have made strong efforts against the enactment of any law that will hamper the industry. In Yuba and Butte Counties which are two of the three most interested counties in the state, the officials and business men were prompt in denouncing the bill as an injustice to an industry that has been the foundation of the great prosperity of the farm sections as well as the commercial interests. Sacramento County, which is the first in gold dredging importance, was slow in acknowledging the benefit that has been derived. The chamber of commerce at first endorsed the bill, but later rescinded the endorsement. The supervisors of Calaveras County held an extra session in conjunction with the county chamber of commerce; and jointly these two bodies protested against the passage of the bill. There are only three dredges operating in Calaveras County, but their operation is conceded to have been a benefit not only to the mining but the farming industry. The largest part of the lands dredged and to be dredged in this county are along the river bottoms and unfit for agriculture. It is conceded that gold dredging has enhanced the values of adjoining nonproductive lands far in excess of any values heretofore placed on them, and these values are greater than could be created at any time in the future by agricultural cultivation. What is true of Calaveras County is true of almost every county in the state where dredging is carried on. Besides the advantages of increased values of lands the further economic result is acknowledged in Calaveras County that the dredges have provided a large amount of heavy gravel suitable for crushing for concrete and road material, that otherwise must be procured at great expenditure of money and labor.

Charges of Mismanagement of the Quicksilver Mining Co. and a demand for the resignation of Charles A. Nones, president, were made at a recent meeting of stockholders and directors of the company in New York. M. E. Harby, L. L. Benedict, Jr., and L. Wallerstein were selected as a committee to ascertain the value of the company's properties. This committee appointed W. H. Landers, of San Francisco, to inspect the books and make a physical examination of the Almaden quicksilver mine in Santa Clara County, Calif. Mr. Landers was at first refused admittance to the mine and an inspection of the books; but the refusal was afterward modified and he was admitted to the mine. It is reported that Mr. Nones' refusal to submit the books was because the former management of the company was under investigation by the Department of Justice. If this is true the California stockholders are ignorant of such investigation. The Quicksilver company has been credited with controlling the quicksilver output of the world, and with producing quicksilver annually to the value of $100,000 to $250,000. The fact is that while the Almaden was once the largest producer of quicksilver in the United States, it has not of late years maintained that position, and never under the present management. The production of the mine in 1912 was increased over 1911, but its production in 1912 was only about 10% of the total production of California, the value of the total output being less than $900,000 in that year. New orebodies were developed in the Almaden in 1912 and the prospects are good for the mine to remain one of the three large producers. It now stands third, with the Idria first and the New Guadalupe second. These three mines produced in 1912 an approximate aggregate of 16,800 flasks; the smaller mines in the state produced approximately an aggregate of 3800 flasks. The total for the state was about 20,600 flasks. The Quicksilver company would control less than 54% provided it controls all the output of the Guadalupe and the smaller mines; but it does not control more than 25% of the smaller mines, and it cannot control the output of the Idria, so that it is not probable that it controls more than 35% of the production of California. It is believed by quicksilver men that the Almaden is still a large mine and capable of further increased production, but that this mine or the company operating it controls the world's production of quicksilver is not so.

DENVER—Apr. 3

The Gilmore Discovery in Southwestern Colorado was made up the Alamosa River nearly one mile above Stunner. The Alamosa River wagon road was washed out during the floods of 1911 and has not since been repaired. The way into the country now is rough and the road indirect. The expected rush of claim stakers and attending influx of population will probably result in inducing the county officials to repair the road when Stunner will, no doubt, become the town of chief importance in the immediate vicinity of the new district. Rich float had been occasionally found on what was locally known as Klondyke mountain, but George Gilmore, who has been prospecting in the La Plata district for several years, first found ore in place and sent samples to Cripple Creek. Immediately thereafter several Cripple Creek mining men went to the site of the new discovery and took up claims. By the time general announcements of the find were made the ground round about the discovery claim was pretty well taken up. The outcrops are said to indicate well defined veins, with sulphide minerals showing near the surface. It is reported that the ore contains tellurides but this has not been authentically confirmed. It is thought that the attention attracted by Gilmore's discovery will reawaken interest in the Platoro district which is in the same general belt as the Gilmore camp, and in Summitville which is about five miles distant in the opposite direction from Platoro.

SALT LAKE CITY—Apr. 3

A Meeting of the Lead and Zinc Ore Producers of Idaho, Montana, Nevada, Utah, Colorado, Arizona and New Mexico was called for the evening of Apr. 3, when measures were to be considered for preventing a reduction of the tariff on those ores. A brief was to be prepared for presentation at Washington, dealing with the industry as a whole, rather than according to states. To further this work, blanks were given to Utah producers to be filled out with statistics as to costs, etc., and if possible presented at this meeting. With New Mexico and Arizona the intermountain states produce more than half of the lead output of the country.

A Metallurgical Research Department is to be established at the Utah State School of Mines, Salt Lake City. The last legislature made a continuing annual appropriation of $7500 to maintain the department, the purpose of which is, to conduct experiments in methods of profitably treating low-grade ores, of securing a high metal extraction, and of obtaining

other information to benefit the mining industry, etc. The new department is to have a director who will be furnished with several graduate students as assistants. The director will have no classes, but will be free from teaching responsibilities, so as to devote his entire time to research work. A suitable man is now being sought for, and recommendations of metallurgists who could make the department realize its aims, are solicited.

The Closing Down of the Consolidated Mercur forecasted in the reports for 1911 and 1912 by John Dern, president of the company, took place Mar. 30. The grade of the ore had become too low to make it possible to operate at a profit, and the property is practically worked out. Last spring stockholders were asked to authorize the sale of equipment and machinery by the directors. It is probable that such a sale will take place in the near future. For several years, operations have been carried on with a view to cover expenses, development having been kept up in the hope of opening more pay ore. As much as $500,000 in gold per annum was produced but earnings were small. Efforts made to find another property, to which to move the plant were unsuccessful. The Consolidated Mercur was formed by combining the Mercur mine owned by Capt. J. R. Delamar with the Golden Gate property. The Mercur was one of the first properties in America to use the cyanide process on a large scale. Later the Golden Gate mill treated up to about 1000 tons of ore per day. The property has a record of large production from low-grade ore. The gross gold output is about $14,000,000, and dividends amounting to $1,235,000 have been paid, since the consolidation. The total dividends by the old and new corporations amounted to more than $3,000,000.

NEGAUNEE—Apr. 2

Scarcity of Labor is becoming serious on the Michigan iron ranges in both the old and new districts, in contrast to conditions 18 months ago when hundreds of good miners were out of work. With the opening of the Mesabi range open pits and the starting of steam-shovel mining, a number of men are leaving the Michigan districts. Miners and trammers are wanted on the Marquette and Gogebic ranges and in the Iron River district.

Electric Power for Mines in the Iron River District was turned on Mar. 9 from the new hydro-electric plant of the Peninsula Power Co. 30 miles away at Twin Falls on the Menominee River. Current had been supplied to a few of the mines for several months by the company's steam auxiliary plant at Iron River, which will now be used only in case of emergency. The following mining companies are being served Wickwire Mining Co., Davidson Ore Mining Co., Verona Mining Co., Bates Iron Co., and Florence Iron Co., of Florence, Wis. In addition current is sold to the cities of Iron Mountain and Iron River. A charge of about 1c. per kw.-hr. on a sliding scale depending on the amount of power contracted for is the rate. The mines do not as yet use electric current to the same extent as is done at the mines of the Cleveland-Cliffs Iron Co. on the Marquette range, but air-compressors, underground-haulage systems and centrifugal pumps are electrically operated. The transmission line is about 30 miles long and the towers are of steel set in concrete with the lowest wire support 40 ft. from the ground. The wiring system is in duplicate, the cables are of aluminum reinforced with steel. Construction on the concrete dam, power house and transmission line has been in progress for 18 months; the entire cost is about $2,000,000. Otto C. Davidson, of Iron Mountain, is president of the Peninsula Power Co., the stockholders are residents of Michigan and Wisconsin. This is the only power company in the mining districts of Michigan which makes a specialty of selling power to mines.

Arrangements for Mining the Mastodon property in the Crystal Falls district have been made by the Longyear interests. They have been exploring the land for several years under the name of the Nevada Land Co. It is reported unofficially that a portion of the extensive property will be leased to Pickands, Mather & Co., of Cleveland, and that the rest will be operated by a mining company organized by the Longyears in Minneapolis in a similar manner to the Cascade find of the company now being developed in the Marquette district. The Mastodon find, said to aggregate 10,000,000 tons, is one of the biggest ever made on the Menominee range, and there has been considerable speculation as to which mining companies would take it over. The extensive orebody was found in a discredited portion of the district and a large sum has been spent in thoroughly exploring the intricate formations under the heavy overburden. The terms asked by the Longyear company for a lease have been so high that most mining companies were unwilling to agree to them. A sliding royalty of more than 50c. per ton, depending on grade of ore, a cash bonus to cover cost of exploration, and a stipulation to remove all ore both high- and low-grade, were included in the terms for lease. Pickands, Mather & Co., has done little exploratory work during late years, but has concentrated on mining its large orebodies in the Iron River district and on the Gogebic range. It is the largest shipper in the Iron River district which is 15 miles distant from the Mastodon section of the Crystal Falls district. Although its orebodies in the Iron River district at the Caspian, Baltic, Fogarty and Bengal are large, aggregating at least 20,000,000 tons, a good proportion of the yearly shipments have been contracted for in advance by the furnace interests affiliated with the company. The terms upon which the Mastodon lands were leased from the original owners, the Keweenaw Association, call for a heavy ground rental or minimum royalty, so that it is probable that mining will be started soon. The Longyear interests which previously confined operations to exploration work, are now mining at several places both in Michigan and Minnesota; they are in close touch with capital in Minneapolis, Duluth and Escanaba. Diamond drilling is still in progress on the Mastodon lands, and the number of drills was recently increased to 10. The Chicago & Northwestern Ry. has a branch line nearby over which shipments will probably be made.

PORTLAND, ORE.—Apr. 2

The American Soda & Potash Co. Contract with the state land board has been remodeled by the consent of the board so as to allow the company to build a dam at the mouth of the Chewaucan River and completely drain Summer Lake. According to the original contract the company was to drain the lake by means of vats. The company secured a 40-year lease on Summer and Albert Lakes for the purpose of extracting the salts in the beds. By building the dam it will be possible to drain the lake completely and make the salts available by January, 1914. In return for the lease the company agrees and guarantees to pay a royalty of at least $50,000 per year, starting with 1913, the first two payments to be made Jan. 1, 1915. The royalties will be $1 per ton on all soda and potash taken from the lakes and 50c. per ton on common table salt, with a minimum of $50,000 a year to the state. C. M. Sain, the manager, states that the company will produce from 200,000 to 400,000 tons of salts per year, and that there are 40,000,000 tons of salts in these lakes. This will be a greater production than is made from the Great Salt Lake of Utah.

VIRGILINA, VA.—Mar. 29

Mining Operations Are Being Resumed in the Virgilina district after having been at a standstill ever since the panic of 1907. It is stated that the outlook is more encouraging than it has heretofore been. S. Durgy, of New Haven, Conn., has secured a lease on the old Blue Wing mine, which is now being unwatered and the machinery is being put into shape. Copper ore has been found on this property, which contains some gold and a little silver. George E. Morong has sold the Copper King property to Knoxville, Tenn., men, chief among whom is Charles A. Weller, who has interested the Partridge people, and it is now planned to put a Partridge hot-blast furnace on the property. Some of the ore has already been tested in the furnace. W. E. C. Eustis, of Boston, is sinking a shaft on his property. The shaft is now 60 ft. deep and some good glance ore is being found.

CHIHUAHUA—Mar. 31

A New Route Has Been Opened to Mexico for through service. As a result of the inoperation of divisions of the National Railways of Mexico, leading to Laredo and Eagle Pass, the New Matamoros-Brownsville route has been opened and from the present results of the service it will probably be made permanent.

Exports of Minerals for the Last Six Months of 1912, as shown in the completed statistics of the Department of Finance, show an increase of 13,597,342 pesos compared with the same period of the preceding fiscal year, the increase in silver exportations alone amounting to 10,435,373 pesos. The silver exported in the last half of 1912 had a value of 54,058,858 pesos. Exports of gold reached a total of 21,356,962 pesos, a decrease of 4,455,262 pesos, and the copper exported had a value of 21,329,348 pesos, an increase of 3,979,378 pesos. The value of the lead shipments was 2,562,274 pesos, a decrease of 408,347 pesos, and of zinc shipments 455,472 pesos, a decrease of 89,433 pesos. Asphalt exports increased to the extent of 313,340 pesos, the total for the six months being 456,663 pesos, and there was a small increase in the antimony exported, the value reaching 888,265 pesos. Other mineral products, principally petroleum, had a value of 4,630,569 pesos, an increase of 3,721,297 pesos. The total value of the minerals exported was 105,840,525 pesos.

THE MINING NEWS

ALABAMA

Jefferson County

ALABAMA IRON CO.—This company has been organized to take over the plant and assets of the Alabama Consolidated Coal & Iron Co., the U. S. court at Birmingham, having signed the decree transferring these properties acquired at foreclosure, to the Baltimore reorganization committee, composed of stockholders of the old company, of which Joshua Levering is chairman.

ALASKA

Fairbanks District

PIONEER—The shaft on this property, on the divide between Cleary and Fairbanks Creeks, is 158 ft. deep. Drifting is now in progress on fair-grade ore. Angus McDougall is owner.

PLUMBUM—Victor Lundblad, Matt Cook and Aaron Cook are developing this claim, on the left limit of Fairbanks Creek. The water level was reached at 35 ft. in the shaft, so drifting is now under way.

NEWSBOY—This mine has been closed down for the present, although the mill is intermittently crushing custom ore. An effort is to be made to raise funds to enable sinking the shaft to the 500-ft. level and explore the vein. On the 315-ft. level, where the last work was done, the vein is reported to be about 6 ft. wide, but the ore is not rich enough to pay mining and milling costs.

Juneau District

ALASKA UNITED—In February, 15,960 tons of ore crushed in the Ready Bullion mill, yielded $36,964, or $2.34 per ton, in bullion and concentrates; the net profit being estimated at $13,171. In the 700-Ft. Claim mill, 18,294 tons of ore crushed, yielded $46,724, or $2.58 per ton, $22,633 being the estimated net profit.

ARIZONA

Cochise County

PARADISE—A concentrator has been built at this property near San Simon.

CALUMET & ARIZONA—At the 2500-ton smeltery being built at Douglas, the blast furnaces should be ready to be blown in either in May or early in June. It is expected that by Aug. 1, the rest of the plant will be completed.

MASCOT COPPER CO.—This company, operating mines 16 miles south of the Southern Pacific R.R. at Willcox, has been doing extensive development work during the last six months. Ore previously discovered by diamond-drilling operations, is being further developed by diamond drilling with two drills, and by driving drifts and crosscuts. A new hoist has been ordered, which will be installed at an underground station in the main working tunnel, and will be used in sinking a deep winze to explore the mine at greater depth. Considerable additional development work has been outlined by the management. F. L. Sizer is general superintendent.

Pima County

CORONATION—This copper prospect, near the R.R.R. has been bonded by Richardson & Bohlinger to Eastern men.

Santa Cruz County

SALERO—Zinc-carbonate ore has been uncovered by W. A. R. Brockaway in the Greaterville district. Preparations are being made to begin shipping at an early date.

Yavapai County

BANNIE—Work has been resumed at this mine under the direction of W. C. Hanson.

COMMERCIAL—Regular shipments are being made from this group in the Copper Basin district.

GREAT REPUBLIC—A small force has been put at work and will be increased as the mine is put in order.

PICKAWAY—The mill is now operating steadily on ores from the Silver Cord group, which is worked under lease.

CASHIER—Drifting is being done on the vein from a crosscut from the big Senator tunnel.

CORONADO—Work has been resumed on this property near Congress by order of the stockholders. W. T. Sawyer is in charge.

SNOOZER—A large quantity of ore has been made ready for shipment, but is held up on account of the condition of the roads.

CLIMAX—This group on the Hassayampa River was recently inspected by R. M. Martin, who ordered resumption of work.

Yuma County

ARIZONA-TEXAS—Regular shipments are being made from this property in the Castle Dome Mountains to the El Paso smeltery.

ARKANSAS

Marion County

RED CLOUD ZINC CO.—In March, 3760 tons of ore yielded 227 tons of concentrate in the mill near Rush. There is much zinc-carbonate ore in the mine. J. C. Shepherd, formerly of Chihuahua, Mexico, is manager

CALIFORNIA

Amador County

SOUTH AMADOR—Good ore has been blocked out, but the management is not anxious to begin mining until more ore is disclosed.

SOUTH EUREKA—The repairing of the shaft is so far completed as to permit starting the pumps. The water rose from the 2900-ft. level to the 2700-ft. level and probably flooded the upper level. By the time the repairs are completed the mine will be unwatered and it is expected to resume mining and milling in April.

Butte County

ST. FRANCIS—High-grade ore has been disclosed in this mine in the Forbestown district.

BOOTJACK—Rapid work in shaft sinking has been done on this mine in the Forbestown district during the winter.

DENVER—This group of claims in the Forbestown district has been taken over by Los Angeles men, who are doing preliminary mining work.

BURLINGTON—Repairs and retimbering in the tunnel have been in progress during the bad weather in the Forbestown district. The prospects are good for the active development of the Mexican and Mexican Two in the spring. W. C. Ralston of San Francisco, manager.

FORBESTOWN CONSOLIDATED—The new 75-ton cyanide plant was reported ready for operation on Apr. 1. The remodeled 20-stamp mill has been ready for some time, and a large quantity of ore has been mined during the development of new orebodies in the Gold Bank and the Golden Queen. Arrangements are being made for the installation of machine drills. M. J. Cooney, of Forbestown, is manager.

Calaveras County

WATERMAN—The bonded indebtedness has been secured by a trust deed to the Citizens Trust & Savings Bank. H. A. Kuns, of Angels is superintendent.

DOLLING GOLD MINING CO.—Notice of delinquent sale of stock has been published. The mine, formerly known as the North Star, is a new property in which ore was mined and milled in 1911 and 1912. Development of new orebodies continued after closing down the mill in the latter half of 1912. G. S. Berry of Angels Camp is secretary.

Mono County

INDIAN QUEEN—This old mine and former producer is being prospected by W. H. Davis of Tonopah. The property is in the Oneota district. T. J. Grant, formerly superintendent of the Granite Mountain mines, in Montana, is superintendent.

Nevada County

PRUDENTIAL—It is reported that negotiations are in progress for leasing the property to San Francisco men. A. P. Wilson has resigned as superintendent. He is succeeded by C. A. Sammons.

BRUNSWICK—It is reported that raising from the south drift on the 1250-ft. level in the old shaft to connect with the new shaft, and the deepening of the new shaft below the 1450-ft. level are about to be resumed, and that a 220-hp. Ingersoll-Rand air compressor has been ordered. The addition of 20 new stamps to the 20-stamp mill is contemplated; 82 men are employed.

Placer County

RALSTON—A diamond drill has just been installed, and it will be used in prospecting.

PACIFIC—At this gravel mine the old Caledonia channel is being opened. William T. Davis is manager.

PENNSYLVANIA POINT—A shaft will be sunk on the main vein at this property two miles west of the Ralston mine.

HERMAN—At this quartz property 20 stamps are crushing high-grade ore. Electric power will be used as soon as the installation work at the shaft is completed.

HOMESTAKE—This gravel mine, comprising about 400 acres, is being operated under the management of James Bryerson; satisfactory recoveries are being made, and 28 men are employed.

EL DORADO—Recent work has resulted in locating the ancient river channel. Results are said to have exceeded expectations, and 50 men will be employed by the manager, E. M. Ray.

RUBLIN—At this quartz property a crosscut, now about 400 ft. in, is being driven with the expectation of cutting the seven known veins in the property. The present workings crosscut the veins about 490 ft. below the surface.

Shasta County

DREDGING LAND ON DRY CREEK has been purchased by Frank Maddaugh and C. O. Silversten, recently engaged in mining in Alaska, who are preparing for a dredge. Andree Brothers, of Igo, were the vendors.

FREE GOLD MINING CO.—This company has been incorporated to develop claims in Grizzly Gulch, near Whiskytown. The directors are Alexander Thatcher, M. C. Thatcher, H. W. Knapp, Jacob Snow and J. S. Gannin, of Shingletown. The capital stock is $50,000. Redding is the principal place of business.

COLORADO

Adams County

AMERICAN SMELTING & REFINING CO.—About 80 men recently went out on strike at the Globe smeltery.

Clear Creek County

ROSEBUD—This company is developing a group of claims on Democrat Mountain under the management of Mr. Teagarten.

PAPOOSE—This property is being developed by lessees. A 14-in. vein of silver-lead ore has been opened; assays of $50 per ton are obtained.

KATIE EMMETT—The shaft is 250 ft. deep. A 6-in. vein of 8-oz. gold ore has been opened. The property is being developed by W. Cannady under bond and lease.

WHEELING—This property is being operated by lessees in the Wilcox tunnel. Old workings have been repaired and retimbered, and a vein of smelting ore 8 to 16 in. wide is being developed.

McCLELLAN—A 10-in. vein of 150-oz. silver ore has been opened in this mine on Leavenworth Mountain. Drifting has been in progress for several months. Shipments of both smelting and concentrating ore are being made regularly.

ORIENTAL—This property on Lincoln Mountain is being developed by a crosscut tunnel. It is estimated that the west extension of the Ohio vein will be reached within 200 ft. The operators contemplate equipping the property with machinery during the summer and undertaking a campaign of development. August Swanson is manager.

Montrose County

CURRAN & HUDSON—A Sampson ore crusher is to be installed at the plant of this company at Naturita. Shipments of carnotite ore to Europe via Galveston were 1,376,145 lb. between Oct. 1, 1911, and Sept. 1, 1912; and 395,300 lb. between Sept. 1, 1912, and Mar. 1, 1913.

Teller County-Cripple Creek District

THE MARCH PRODUCTION FROM THE CRIPPLE CREEK DISTRICT shows an increase of $91,275 over that of February with a greater tonnage by 19,365 tons. The shippers with corresponding tonnages and values are as follows: Smelters 3750, $253,750; Portland 10,000, $210,000; Portland (Cripple Creek district) 15,700, $51,182; Stratton's Independence 10,390, $29,092; Kavannaugh 1800, $3870; Gaylord 1500, $4500; Ajax 4500, $12,600; Golden Cycle 32,000, $640,000; Wild Horse 1200, $5040; Isabella 1100, $2200; Total 81,940, $1,162,234.

BLUE FLAG—The mill on Raven hill will be started as soon as some new machinery can be installed.

ELKTON—Sinking of the main shaft to a depth of 1150 ft. has been completed and a station is now being cut at the 12th level. On the 1050-ft. level, the main shoot has been developed and has been found to be one of the richest and largest bodies of ore yet uncovered.

AJAX—In addition to the method of gold extraction followed in the Colburn mill, of the modified form of the Clancy electro-chemical process, four concentrators have been installed over which one product is sent, or about 40 tons of the 200 tons treated daily.

IDAHO

Cœur d'Alene District

TYLER LEASE—Howard McBride and associates, operating this lease, have let a contract for a 2300-ft. double-bucket aërial tramway. Construction work will begin at once.

STEMWINDER—Two new leases have been let on the old workings of this mine by the Bunker Hill company. The lessees have begun operations, and while no ore is being mined, considerable prospecting and development work is being done.

IDORA HILL—Construction work has been resumed on the mill after enforced idleness throughout the winter. The foundations were in place before winter set in, so that the work now can be quickly completed. All the material and equipment have been delivered at the mine. The mill will have a capacity of 50 tons. Work has been going on all winter at the mine and ore has been developed.

FEDERAL MINING & SMELTING CO.—In a letter mailed to shareholders, Frank Sweeny, secretary, states that earnings for the first six months of the fiscal year, to Mar. 1, were approximately $520,000. This averages $86,500 per month or an annual rate of 8½% on the preferred stock. The company is now paying 6%. These earnings were made in spite of the prevailing low price of lead, the company's main product, due to the tariff agitation and to the severest winter the Cœur d'Alene country has known in 30 years; there having been almost a blizzard as late as Easter Sunday. It is expected that the company's policy of extending its holdings without spending or risking any considerable amount of its surplus will be continued.

ILLINOIS

Hardin County

ROSICLARE—These fluorspar mines are reported flooded by the rising of the Ohio River; the extent of the damage is not yet known.

MICHIGAN

Copper

LA SALLE—Preparations are being made to install an electrically driven pump at the 12th level of No. 2 shaft.

ST. LOUIS—The shaft is down about 600 ft. Drifting is being done at the first and fourth levels on either side of the shaft.

AHMEEK—Plans are being made for enlarging the stamp mill and ground will be broken as soon as the snow is off the ground.

ISLE ROYALE—This company's stamp mill is now operating at full capacity. Much mass and heavy copper is being encountered in the lower working on the main Isle Royale lode.

INDIANA—The shaft has reached a depth of about 1400 ft. where a station is being cut preparatory to driving a crosscut to cut the formation that was revealed about two years ago in diamond drilling.

OJIBWAY—Encouraging ground is being opened below the 17th level. Drifting north at this level is being done. At No. 2 shaft a diamond drill is drilling at the intersection of the crosscut and the lode at a depth of 2000 feet.

SOUTH LAKE—This company is cutting a station at a depth of 300 ft. and will drive a crosscut to test the No. 3 formation at that depth. This lode was about 40 ft. wide and well mineralized at the point of intersection with the shaft.

HOUGHTON COPPER—It is planned to resume sinking at this company's shaft which has been bottomed for some time at a depth of 625 ft. It will necessary to reinforce the shaft for a considerable distance, owing to the broken ground through which it has been sunk.

MASS—Shaft "C" is bottomed at a depth of about 1400 ft. where a station is being cut and connections will be made with Shaft "B" at the 13th level. As soon as the station is cut sinking will be resumed. Shaft "B" is developing good ground on the Evergreen lode in a stope between the 8th and 6th levels. One head of the mill is operating continuously at full capacity.

Iron

BENGAL—A steel headframe is being erected at this new mine of the Verona Mining Co. at Stambaugh.

CHATHAM—A new machine-shop was recently completed at this mine of Oglebay, Norton & Co., in the Iron River district.

VIRGIL—This new mine of the Wickwire interests, operating under the name of the Buffalo Iron Mining Co., is to be operated by electricity supplied by the Peninsula Power Co. An electrically driven air compressor has been purchased. Shaft sinking is in progress.

SMITH—This mine of the Cleveland-Cliffs Iron Co. in the Gwinn district will shortly resume operations after having been closed for two years; it is as yet only in the development stage with a concreted shaft and a few drifts. The reopening has been delayed since last year by delays in the arrival of electric pumps for unwatering the workings.

TRADERS—This open-cut mine of the Antoine Ore Co. north of Iron Mountain is being put in condition to make a large shipment during the coming season, and the pits are being drained. The property is only operated during the summers of prosperous years, as the ore is low-grade and high in silica, containing 39% iron and 42% silica but with low phosphorus and sulphur. About 1,500,000 tons have been shipped from this mine since 1895, when it was opened, the largest shipment, 195,000 tons, having been made in 1906. The Republic Iron & Steel Co. controls the operating company.

MISSISSIPPI

Marshall County

IRON DEPOSITS IN THE VICINITY OF POTTS CAMP are now being examined with the intention of developing them into large producers in the near future.

MISSOURI

Flat River District

ST. JOSEPH LEAD CO.—Certain stockholders who are said to hold $500,000 worth of stock have filed a complaint alleging mismanagement and the making of contracts with the Doe Run Lead Co. to purchase lead at a price operating to the disadvantage of the St. Joseph company. An accounting is asked. The complainants, chief of whom is Robert Holmes, previously sought to have a suit brought against the company in Missouri through the attorney general, but the application was denied.

Joplin District

A NEW LEAD MINE IS BEING OPENED AT BELVILLE. A steam hoist has been installed and the ground opened in good shape. The ore is cleaned on three hand jigs.

CHICAGO-LEHIGH—This mine at Lehigh, which has been a heavy producer for several months, is running into better ore and will make a larger production than heretofore.

ST. LOUIS-JOPLIN LEAD & ZINC CO.—This company has purchased 52 acres of mineral land near Belville. The land has not been extensively developed, and the intention is to thoroughly prospect it with a churn drill.

REO MINING CO.—This company is now interested in developing a 40-acre tract northeast of Sarcoxie. Seven holes have been drilled showing ore 12 to 30 ft. thick. A shaft has been sunk and a mill is contemplated. This company also has a producing mine on the Elliot land west of town.

IMPERIAL MINING CO.—This company, a new operator in the North Webb City sheet ground, is getting ready for a large production. Four shafts tap the orebody at 198 ft. These shafts are now being connected by drifts for ventilation and haulage. The ground to the east has been mined out and 10 acres of the 40 leased.

MONTANA

Butte District

BUTTE CENTRAL—Miners have quit work, according to press dispatches, because of non-payment of wages.

BUTTE & GREAT FALLS—A shaft is being sunk on the property of this company in the northern part of the district. The sinking force has been increased in order to reach the 300-ft. level more quickly, at which depth development work will be started.

NORTH BUTTE—About 2,225,000 lb. of copper is being produced monthly from this property, principally from the 2400-ft. level. The Granite Mountain shaft has reached the 2200-ft. level and will be continued to the 2800-ft. level. This shaft is used as an air shaft and for lowering timbers and supplies, connections being made with the Speculator workings every 200 ft. As soon as it reaches the 2800-ft. level, which will be in six or eight months, the Speculator shaft will be closed for repairs. Electric motors for ore-hauling purposes have been installed on all levels from the 1800- to the 2800-ft. levels.

Deer Lodge County

HOLDFAST—From this property at Georgetown, about three carloads of ore per week are being shipped to the Washoe smeltery, and an increase of this output is planned; Robert Lindberg is in charge.

BALTIC COMBINATION—Good ore was opened some time ago at this mine, and drifting on the vein is progressing steadily, the ore improving as the work goes on. A winze has just been started on this ore.

SOUTHERN CROSS—The installation of the new electrically operated hoist at this property of the Anaconda Copper Mining Co., in the Georgetown district, has been completed. The power for operating the hoist will be generated at the Flint Creek power station. A new steel headframe has been erected and the cable is now being attached. The company expects eventually to mine at considerable depth as the new plant is capable of hoisting from the depth of 2200 feet.

Lewis & Clark County

VALLEY FORGE—Several years ago about $300,000 worth of ore was mined in surface workings at this property near Rimini. It was then necessary to sink a shaft and install a pumping plant, or to drive a tunnel at the foot of the mountain. The tunnel was driven 350 ft. when lack of money compelled suspension of the work. Last autumn stockholders contributed $50,000 for the completion of the tunnel, and work was resumed. The tunnel is now in 1600 ft., and is expected to tap the ore about 250 ft. further in and at a depth of approximately 900 ft. from the surface. The ore contains gold, silver and lead, in a wide vein.

Madison County

BEDFORD—Preparations are being made to install an electric hoist at this property near Virginia City. The power line has been completed to the mine by the Madison River Power Co., and the transformer has just been delivered.

BULLION—From one to three carloads of ore per week are being shipped from this mine on Miller Creek, near Sheridan. Sinking of a new shaft in order to reach known ore more economically will soon be started; A. B. Clark is in charge.

GRAND VIEW—The purchase by this company of the mines and improvements of Daniel E. Minier, Jesse Johnson, C. H. Clodius, John Bradley, Henry Schmidt and A. B. Schmidt has just been completed. These mines in the Tidal Wave district have been producers in the past, and consist of the Washington, Snowstorm, Grand View, Red Bell Nos. 1, 2 and 3, Two Sisters and Wolframite Nos. 1 and 2.

Park County

YELLOWSTONE PORTLAND CEMENT CO.—This company, which owns large deposits of white limestone near Livingstone, on the outskirts of Yellowstone Park, has given a contract for the construction of a cement plant to George Woody, of Butte.

NEVADA

Comstock Lode

THE MEXICAN COMPANY HAS REFUSED TO PAY THE PUMPING ASSOCIATION'S demand, according to press dispatches, and there is danger that the Comstock Pumping Association may be disrupted and that the flooding of the Comstock lode up to the level of the Sutro tunnel will result from this action of the Mexican Gold & Silver Mining Co. The trouble is deep seated, involving the alleged San Francisco brokerage ring.

YELLOW JACKET—The mill has resumed operations.

OPHIR—The understope below the 2400-ft. level is being carried down three sets wide in the ore.

COMSTOCK-PHOENIX—The tram from the mine workings to the Sixmile cañon has been completed, and from the end of the tram, the ore will be taken by team to the mill.

NEW YORK—A 75-hp. Fairbanks-Morse electric hoist and motor have been ordered. The mine will be reopened to the 1200-ft. level, from which point access will be gained to the Caledonia, controlled by the same men.

MEXICAN—The tramway connecting the mill with the Monte Cristo in Sevenmile cañon has been completed, and the transportation of ore has been begun. The ore thus far mined and milled assayed $14 per ton. The Mexican has now practically extracted all the ore developed above the 2500-ft. level of its own property.

Nye County

TONOPAH EXTENSION—A new oreshoot has been opened south of and parallel to the south vein.

MONTANA-TONOPAH—A new oreshoot opened on the 515-ft. level of the Macdonald vein, has been drifted on for 60 feet.

MIDWAY—The new main working shaft is 600 ft. deep and crosscutting to the veins in the old workings has been commenced.

HALIFAX—A flow of 150,000 gal. of water has been encountered and pumps are being installed. The shaft now 1560 ft. deep, will be continued to the 1700-ft. level.

JIM BUTLER—Drifting east and west is now in progress on the seventh level on full faces of good ore and drifting has also been started on the sixth level on a small but rich vein to the south.

SHIPMENTS in tons from Tonopah mines for the week ended Apr. 5, were as follows:

Tonopah Mining	3200	North Star	....
Tonopah Belmont	3665	Mizpah Extension	....
Montana-Tonopah	1049	Jim Butler	400
Tonopah Extension	1050	Tonopah Merger	....
West End	1000		
Midway	100	Total	11,048
MacNamara	584	Estimated value	$237,380

White Pine County

GOLD KING MINING CO.—Several cars of high-grade ore are ready for shipment from this property at Joy. A five-stamp mill will be built this summer; August Munter, manager.

ELY NATIONAL—This company recently sent ore from its mine near Hamilton to Germany to be tested for platinum. Platinum to the value of $8 per ton was found.

BOSTON-ELY—Work has been resumed, from the 1100 level. The 1200 was recently drowned out, causing closing down of the property. Driving for the Matilda vein, which was found on the 1200, will be started on the 1100 level.

NEVADA CONSOLIDATED—Water from the Ely Consolidated shaft is being pumped for use as that property is shut down, probably permanently. At the mill 16 Dorr thickeners are being installed. The settling ponds completed last year are unsatisfactory, as it is difficult to clean them out and they rapidly become filled with slime. The water supply is seriously interfered with. More ore is being taken than formerly from the Liberty pit.

NEW MEXICO

Grant County

SAVANNA COPPER CO.—A new compressor is being installed at this mine, and the "B" shaft will be sunk from its present depth of 300 ft. to a depth of about 700 feet.

Lincoln County

YELLOW JACKET—This mine, about 10 miles northeast of Carrizozo, has been opened again and work is reported to be progressing satisfactorily. About 20 men are employed, and the force is soon to be increased.

OKLAHOMA

Ottawa County

MIAMI ZINC & LEAD CO.—This mine has made an excellent showing since operating was begun three weeks ago.

THIRTY ACRE MINING CO.—This company recently began operations again after completing a new 250-ton bin and tramway at the north shaft and installing a gas engine and compressor.

LOST TRAIL—This company will soon begin the construction of a new mill. This lease has been thoroughly developed and the shaft which is being sunk is now down to pay ore containing both lead and zinc.

GREYTOP MINING CO.—Operations will be commenced within the next two or three weeks. The mine has been proved by drilling. The mill now under construction will have a capacity of 500 tons. It has nine sets of rolls and will be driven by a 150-hp. gas engine and a 75-hp. steam engine. R. J. Danforth is manager.

CARLSON DODSON MINING CO.—This company began operating about five weeks ago. The mill is of 500 tons capacity, being one of the largest in the camp. It is now running at full capacity. The lease was developed thoroughly before the mill was built. About 50 men are working now and more will be put to work as soon as room can be made for them. L. C. Church is manager.

PENNSYLVANIA

Cumberland County

ALUMINUM CO. OF AMERICA—The employees of this company at New Kensington are out on strike.

SOUTH DAKOTA

Lawrence County

WASP NO. 2—After a suspension of one month during bad weather, the mill resumed operations Apr. 1.

BISMARCK—The new mill, adjoining the Wasp No. 2, is gradually being worked up to full capacity, 300 tons per day.

NEW RELIANCE—Beginning Apr. 1 the entire complement of 30 stamps has been dropping 24 hr. per day. About 100 tons of ore is being handled daily. The ore is hard, and is being crushed fine, more than half of the stamp product passing a 100-mesh screen. A Portland filter is used, following a continuous decantation process, using Dorr mechanical thickeners in a series of four tanks.

HOMESTAKE—A cage at the Ellison shaft, loaded with four cars, each holding about one ton of rock, recently dropped from between the 300 and 400 level to the bottom at a depth of 1800 ft. Failure of a clutch is given as the cause of the accident. At the 1700-ft. level the cage crashed through a bulkhead of 12x12-in. timbers, and brought up on a similar bulkhead over a 60-ft. sump. The cable followed the cage to the bottom, and it was found necessary to cut it into pieces in order to remove it. In breaking loose the cable did a little damage to the reel, and this and repairs to the shaft, removing the broken cage, etc., necessitated suspending work for about two weeks.

TEXAS

El Paso County

A SCHOOL OF MINES AND METALLURGY IS TO BE ESTABLISHED at El Paso, as a branch of the University of Texas, if a bill which has recently passed both houses of the legislature is signed by the governor.

UTAH

Juab County

TINTIC SHIPMENTS for the week ended Mar. 28, were 193 cars.

CHIEF CONSOLIDATED—A station has been cut on the 1800-ft. level, and shaft sinking was suspended at 1815 ft., where water came in.

DRAGON—Extensive development is being carried on, the funds being derived from the sale of iron ore and copper ore from workings opened through the Black Jack.

GRAND CENTRAL—The winze from the 2300 level is down 80 ft. with low-grade ore all the way. Drifting will be started from the bottom of this winze. Water was encountered a short time ago.

Salt Lake County

CEDAR-TALISMAN—Work has been resumed.

UTAH COPPER—The February output was 7,819,900 lb.

RED WARRIOR—Some ore is being shipped from this property.

LIVE YANKEE—This property, closed down from fear of snowslides, will be worked in the spring.

BIG GENTILE—An inclined shaft is being sunk on the dip of a vein carrying lead, silver, and gold. This mine adjoins the Moscow on the north.

U. S. SMELTING, REFINING & MINING CO.—The regular quarterly dividend of 87½c. on the preferred and 50c. per share on the common stock has been declared.

PACIFIC—This company's output for the last two years is stated to amount to almost $20,000 worth of sulphide ore mined at greater depth than has been reached by any of the other mines of the district.

SHEEP ROCK—The five-stamp mill is treating ore from the Sheep Rock and other properties. Electricity may be used in the mine, and power drills may be used to take the place of hand tools.

WILD DUTCHMAN—This property, the past output of which is said to amount to over $500,000, is being worked by lessees, who will ship as soon as the weather permits. A recent strike is reported.

UTAH CONSOLIDATED—A dividend of 50c. per share has been declared payable Apr. 12. Profits for the year ended Dec. 31, 1912, were $603,923. There was produced 6,506,804 lb. copper, 8,734,398 lb. lead, 230,004 oz. silver, 14,042 oz. gold.

MILLER—This mine is stated to have produced $3,000,000 gross in the past, most of which came from carbonate ore. It is at present being worked by lessees, and shipments have been kept up for the last two years by the Erickson lease, which, however, has been prevented from shipping during the winter season by bad weather. Another lessee is stated to have 100 sacks of carbonate ore, awaiting better roads for shipment.

Summit County

PARK CITY SHIPMENTS for the week ended Apr. 28, were 2,104,390 lb.

SILVER KING CONSOLIDATED—The shaft is being sunk from the 1300- to the 1800-ft. level at the rate of 5 ft. per day.

ONTARIO SILVER—The annual report for 1912 shows cash on hand of $228,854. Stock in one of the subsidiary companies, the Park City Power Co., owned by this company, was sold for about $180,000. Ore sales and royalties amounted to $8286. Certain parts of the mine above the 900 level have been leased to the Mines Operating Co., and besides royalties the company receives 50,000 shares of stock in the Mines Operating Co. Work was started in October in stopes on the No. 2 drain tunnel, or the 1500 level, where ore is thought to have been left. Ore has been found in several raises, but is difficult to extract on account of poor ventilation. In the sale of the Park City Power Co.'s stock, reservation was made for sufficient water for future milling purposes. The company owns 801 acres of mining ground, four-sevenths of the Webber Coal Co., 75,000 shares in the Thompson-Quincy Mining Co., one-third of the capital stock of the Nail Driver Mining Co., four-sevenths of the Ontario Drain Tunnel No. 1, and half of the No. 2 Drain Tunnel. J. E. Bamberger is president and Earnest Bamberger treasurer.

WASHINGTON

Cowlitz County

LEWIS RIVER HYDRAULIC MINING CO.—A small stampede to the Horseshoe Falls district is in progress and about 20 men have taken up claims near the property of this company on the north fork of the Lewis River. The company is building a dam that will give a fall of 45 ft., which will be ample for washing the gravel through the sluices.

Stevens County

UNITED COPPER—A 35-ton shipment of high-grade ore was made recently from this mine. Conrad Wolff, Spokane, is in charge.

PACIFIC COPPER MINING & SMELTING CO.—Good ore has been encountered in the tunnel on this property in the Chewelah district.

COMSTOCK—This property near Newport has been purchased by the Bead Lake Gold-Copper Mining Co. Plans for extensive improvements are being made.

CANADA

Ontario-Cobalt

COLONIAL—This mine has been temporarily closed down.

GOULD CONSOLIDATED—The shareholders at a meeting held in Ottawa, Mar. 29, voted to place this company in liquidation.

LITTLE NIPISSING—The holders of the mortgage against this property, on which $21,000 is due, have taken proceedings to foreclose.

TWENTIETH CENTURY—The plant, which was destroyed by fire several months ago, has been rebuilt and active operations resumed with Seymour Stevens in charge.

BEAVER—The strike has been amicably settled, the men voting to return to work. The mine and mill have resumed operations after being closed down for eight days.

DRUMMOND—It is understood that this mine has been sold for $500,000, and that an arrangement has been effected by which the new owners will cede their riparian rights in Kerr Lake to the Crown Reserve and Kerr Lake companies.

Ontario-Cobalt

SHIPMENTS of ore and concentrates in tons, from Cobalt mines for the week ended Apr. 5, were as follows:

Bailey	22.35	Kerr Lake	30.31
Beaver	....	La Rose	32.81
Buffalo	....	Lost and Found	....
Casey Cobalt	....	McKinley-Darragh	42.07
Chambers-Ferland	32.30	Nipissing	49.07
City of Cobalt	34.50	Nipissing Reduction	....
Cobalt Lake	....	O'Brien	....
Cobalt Townsite	82.00	Penn.-Canadian	....
Colonial	....	Provincial	....
Coniagas	75.64	Right of Way	....
Crown Reserve	....	Seneca Superior	....
Dominion Reduction Co.	....	Silver Queen	....
Drummond	30.82	Timiskaming	....
General Mines	....	Trethewey	23.92
Green Meehan	....	Wettlaufer	....
Hargraves	....		
Hudson Bay	....	Total	455.79

Ontario-Porcupine

LONG LAKE GOLD CO.—This company has started its new 20-stamp mill and is treating on an average of 75 tons of ore per day.

PEARL LAKE—According to an official statement by R. W. Stevenson, managing director, development has shown a marked increase in ore grade from the 400- to the 600-ft. level. A mill test of 300 tons indicates a value of $35 per ton. Levels will be opened at depths of 400, 600, 800 and 1000 ft. and raises will be made from the 1000-ft. level to where the veins dip into the Pearl Lake property and intermediate levels will be opened on the vein at 100-ft. intrvals. It is planned to build a mill with a capacity of 250 tons per day, grinding to be done in cyanide solution from the beginning of the treatment.

MEXICO

Aguascalientes

AMERICAN SMELTING & REFINING CO.—The smeltery was forced to shut down recently because of traffic interruption, making it impossible to get in supplies of coke, but operations have now been resumed.

Guanajuato

FURNESS MINES—A close corporation with a capital of $500,000 has been organized to operate the San Gregorio and Dolores mines of the Dwight Furness interests. New development work has been in progress at the San Gregorio for several months, and plans have been made for a 100-ton reduction plant. New work at the Dolores will soon be started. The properties are 10 miles apart.

Jalisco

ZAPOTE—A tunnel is now being driven and prospecting is being continued at this group of mines.

MAGISTRAL-AMECA COPPER CO.—The rebuilding of the mill at this mine has been completed, and the mine is being operated.

CIA. MINERA LA REGINA—This company is operating a mine near Hidalgo, on a small scale. M. J. Slattery, of Guadalajara, is manager.

AMAJAC MINES CO.—Shipping ore nearly 6 ft. wide has been opened in the Animas mine. Machinery for the 50-ton cyanide plant will be assembled before the opening of the rainy season, and the plant will be completed during the latter part of this year.

CINCO MINAS—All machinery for the reduction plant, electrical equipment, and structural steel for the mill buildings, have been ordered. The foundations for the plant have been completed. It will have a capacity of between 250 and 300 tons daily, and there will be 30 heavy stamps, five tube mills, concentrators and a complete cyanide annex. The company has completed a wagon road from the Southern Pacific station at Magdalena to the mine.

Zacatecas

MEZQUITAL MINING CO.—Pachuca tanks, Dorr thickeners, and Oliver filters will be added to the remodeled reduction plant at the Mezquital del Oro mine. Mill tests have been in progress since February.

CUBA

A COPPER MINE on the outskirts of the northern coast municipal boundary of Mantua, Western Cuba, will be exploited by Dr. Alfredo Porta y Rojas and Manuel Luciano Diaz. Work has already been started.

GREAT BRITAIN

A STRIKE IS THREATENED by the coal miners in South Wales who have given one month's notice that they will quit if non-union men continue to be employed in the mines.

SPAIN

A STRIKE WAS CALLED AT RIO TINTO, Apr. 3, about 2700 miners going out, but the trouble was adjusted and work resumed five days later.

AFRICA

Rhodesia

GOLD PRODUCTION IN FEBRUARY is reported at 49,596 oz., which is 2859 oz. less than in January, and is the smallest output given for any month since February, 1911. For the two months ended Feb. 28, total was 100,840 oz. in 1912, and 102,051 oz. in 1913; an increase of 1211 oz. Other mineral production in February, 1912, included 11,596 oz. silver, 29 tons lead, 7299 tons chrome ore and 17,987 tons coal. The diamonds reported were 83 carats.

ASIA

Chosen

ORIENTAL CONSOLIDATED—The cleanup for March is estimated to be worth $148,275.

THE MARKET REPORT

METAL MARKETS

NEW YORK—April 9

The metal markets seem to be on a firmer basis, with more business reported in most lines. Copper is inclined to hold the recent advances.

Copper, Tin, Lead and Zinc

Copper—The rise which began toward the end of March continued through last week, prices advancing smartly under the influence of heavy buying from Europe, the volume of business becoming particularly large about Apr. 7, when acceptances of offers made on the previous Saturday were cabled. The bulk of this business seems to have been done at about 15⅜c., delivered in Europe; corresponding to about 15.15c., cash, New York. After selling largely at about that figure most of the agencies advanced their price to 15½c. and the consummation of business at that price was talked about. However, copper was available at 15.45c., c.i.f., and sales were made at that price while 15½c. was asked. The aggregate of the business transacted during the week has amounted to some tens of millions of pounds. By far the major part of the business was done with Europe, American buyers having figured in the market only to a small extent. The price asked of them was 15½c., delivered, 30 days. The producers of Lake copper whose output goes chiefly to American consumers report nothing but insignificant business during the week.

The statistics which were published on Apr. 8 throw a very favorable light upon the intrinsic position of the metal, and it would seem that producers of copper are justified in viewing the future outlook with complacency. The close is firm at 15.35@15.55c. for Lake copper, and 15.20@15.30c. for electrolytic copper in cakes, wirebars and ingots. Casting copper is quoted nominally at 15@15.05c. as an average for the week.

The standard market has moved within narrow limits throughout the entire week, and now that the level of standard prices is in proper proportion to the refined sorts, speculation has subsided somewhat. The close is cabled at £68 7s. 6d. for spot, and £68 5s. for three months.

Base price of copper sheets is 21@22c. per lb. Full extras are charged, and higher prices for small quantities. Copper wire is 16½c. carload lots at mill.

Copper exports from New York for the week were 7060 long tons. Our special correspondent gives the exports from Baltimore at 1399 tons for the week.

It is reported that there is much unrest among the miners of the Lake Superior copper region and a strike early in May is feared by the companies.

Tin—The middle of last week there developed a tendency among domestic dealers to undercut the quotations made for import. This, however, changed towards the end of the week when it became apparent that imports during this month would be comparatively small and that there would be a danger of a shortage of spot and near-by material. Considerable business was placed abroad, with the result of advancing quotations, and the market closes firm at £218 15s. for spot and £215 10s. for three months, and 48½c. in New York.

Tin shipments from the Straits in March were 4810 long tons; a decrease of 340 tons from March of last year.

Lead—The market is quiet and unchanged at 4.15@4.20c. St. Louis, and 4.30@4.35c. New York. The tone of the market, however, appears to be a little weaker.

The London market has been extremely firm on account of reports of strikes in Australia, as well as the heavy reduction in shipments from Mexico, where several of the smelters have been compelled to shut down due to their inability to secure supplies, particularly coke. The close is firm at £17 5s. for Spanish lead and 7s. 6d. higher for English.

Spelter—The output of ore from all producing sections is exceedingly heavy and there has been a good deal of pressure to place spelter against current purchases of ores. As the inquiry from consumers has been restricted, sales could only be effected at concessions, and the market has again experienced a rather sharp decline. A fairly large tonnage is reported sold. There is now plenty of spelter available for any delivery, production having evidently overtaken consumption, and while there is no anxiety manifested on the part of the producers, there is, nevertheless, a desire to make sales right along. Quotations at the close are 5.55@5.65c. St. Louis, and 5.70@5.80c. New York, and the tone of the market is weak.

The London market is firm at £25 for good ordinaries and £25 7s. 6d for specials.

Base price of zinc sheets is $8 per 100 lb., f.o.b. La Salle-Peru, Ill., less 8% discount.

The American Metal Co., on Mar. 15, assumed the operation of the zinc works at Altoona, Kan., under a long lease from the Kansas Zinc Co. At present five blocks of furnaces are in operation in this plant.

It is reported that the Butte & Superior Copper Co. is now producing at the rate of 10,000 tons of blende concentrates per month.

DAILY PRICES OF METALS

NEW YORK

Apr.	Sterling Exchange	Silver	Copper		Tin	Lead		Zinc	
			Lake, Cts. per lb.	Electrolytic, Cts. per lb.	Cts. per lb.	New York, Cts. per lb.	St. Louis, Cts. per lb.	New York, Cts. per lb.	St. Louis, Cts. per lb.
3	4.8710	58⅜	15¼ @15⅜	15.05 @15.15	47½	4.30 @4.35	4.15 @4.20	5.75 @5.85	5.60 @5.70
4	4.8705	58	15.35 @15.55	15.10 @15.20	47⅜	4.30 @4.35	4.15 @4.20	5.75 @5.80	5.60 @5.65
5	4.8710	58¼	15.35 @15.55	15.10 @15.20	48	4.30 @4.35	4.15 @4.20	5.70 @5.80	5.55 @5.65
7	4.8695	59	15.35 @15.55	15.15 @15.20	48¼	4.30 @4.35	4.15 @4.20	5.70 @5.80	5.55 @5.65
8	4.8695	59	15.35 @15.55	15.20 @15.30	48⅛	4.30 @4.35	4.15 @4.20	5.70 @5.80	5.55 @5.65
9	4.8695	59	15.35 @15.55	15.20 @15.30	48½	4.30 @4.35	4.15 @4.20	5.70 @5.80	5.55 @5.65

The quotations herein given are our appraisal of the market for copper, lead spelter and tin based on wholesale contracts with consumers without distinction as to deliveries; and represent, to the best of our judgement, the bulk of the transactions, reduced to basis of New York, cash, except where St. Louis is specified as the basing point. The quotations for electrolytic copper are for cakes, ingots and wirebars. The price of electrolytic cathodes is usually 0.05 to 0.10c. below that of electrolytic. We quote casting copper at 0.15c. below the price for electrolytic. The quotations for lead represent wholesale transactions in open market for good ordinary brands, both desilverized and non-desilverized; the specially refined corroding lead commands a premium. The quotations on spelter are for ordinary Western brands; special brands command a premium. Silver quotations are in cents per troy ounce of fine silver.

LONDON

Apr.	Silver	Copper			Tin		Lead, Spanish	Zinc, Ordinaries
		Spot	3 Mos	Best Sel'td	Spot	3 Mos		
3	26¾	67¾	67⅛	73¾	217⅜	213⅜	16⅞	25
4	26⅛	68⅞	68⅝	74	217	213⅜	16⅝	25
5	26⅛	....	....	....	....	....	....	....
7	27⅛	68	67¾	74	218¾	215¼	16⅛	25
8	27⅛	68¼	68¼	74	218¼	214⅜	16⅞	25⅛
9	27⅜	68⅜	68¼	74½	218¾	215⅛	17¼	25

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb, except silver which is in pence per troy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, pot and three months, and for best selected, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given: £10 = 2.17¼c.; £15 = 3.26c.; = £25 = 5.44c.; £70 = 15.22c. Variations, £1 = 21¾c.

Other Metals

Aluminum—The market is a little quieter, though demand continues good. Supplies are rather better. Prices are a little easier, and we quote 27@27½c. per lb. for No. 1 ingots, New York. The foreign market is firm.

Antimony—The market continues dull, hardly more than a retail business doing. Prices are unchanged, Cookson's being quoted at 9@9.25c. per lb. and Hallett's at 8.50@8.75c.; while 7.90@8.25c. is asked for Hungarian, Chinese and other outside brands.

Quicksilver—The market remains quiet, and there is no material change in prices. The New York quotation may be given at $39@40 per flask of 75 lb., with 58@59c. per lb. for small lots. San Francisco $40 for domestic orders and $37.50 for export. London price is £7 10s. per flask, with £7 5s. named from second hands.

Magnesium—The price of pure metal is $1.50 per lb. for 100-lb. lots, f.o.b. New York.

Gold, Silver and Platinum

Gold—The price of gold on the open market in London was unchanged at 77s. 9d. per oz. for bars and 76s. 4d. per oz. for American coin. There is still a demand from Germany, but not sufficient to cause the payment of a premium.

Iridium—Supply continues short and prices remain very high, $85 per oz. being asked by dealers and generally paid.

Platinum—The market continues steady with a fair business. Dealers here ask $45@46 per oz. for refined platinum and $49@53 for hard metal. The foreign market is reported strong, and there is some expectation of higher prices.

Our Russian correspondent writes under date of March 27 that the market is strong. The demand is higher especially from abroad. The starateli's platinum has again appeared on the market, and the metal has been bought up by the speculators. The Government has again introduced before the State Council the law about the platinum industry. It is proposed to prohibit the export of crude platinum by imposing an export duty of 30% of the value of the metal. The prices remain generally unchanged: The quotations are at Ekaterinburg 9.70 rubles per zolotnik; in St. Petersburg, 37,700 rubles per pood for crude metal, 83% platinum—equal to $36.47 and $36.95 per oz., respectively.

Silver—The market continues steady. Buying on China account recently has tended to steady the market. Stocks in London and the Eastern ports are regarded as large, yet it is believed that Indian speculators have in mind higher prices.

Coined silver in the United States Apr. 1, as estimated by the Treasury Department: Standard dollars, $565,556,020; subsidiary coins, $174,981,948; total, $740,537,968. Of the dollars $474,826,000 are held in the Treasury against silver certificates issued.

Exports of silver from London to the East, Jan. 1 to March 27, reported by Messrs. Pixley & Abell:

	1912	1913	Changes
India	£1,698,300	£2,084,000	I. £385,700
China	415,000	95,000	D. 320,000
Total	£2,113,300	£2,179,000	I. £ 65,700

Exports of gold from London to India were £183,000 for the week.

Zinc and Lead Ore Markets

PLATTEVILLE, WIS.—April 5

The base price paid this week for 60% zinc ore was $40@44. The base price paid for 80% lead ore was $52@53 per ton.

SHIPMENTS WEEK ENDED APRIL 5

	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Week	1,351,500	.....	936,640
Year to date	39,383,910	1,638,440	15,496,800

Shipped during week to separating plants, 2,257,020 lb. zinc ore. Shipments were light due both to low prices and impassable wagon roads.

JOPLIN, MO.—April 5

The high price of zinc blende is $47, the base per ton of 60% zinc $40@44. Calamine sold at $19@22 per ton of 40% zinc. The average of all grades is $41.50. Lead continues at $55.50 high and a base of $53.50 per ton of 80% metal contents, the average of all grades being $52.92 per ton.

SHIPMENTS, WEEK ENDED APRIL 5

	Blende	Calamine	Lead Ore	Value
Totals for week.	12,280,780	424,290	2,208,940	$322,158
14 weeks	143,512,530	10,088,740	26,371,880	$4,317,382

Blende value, the week, $258,864; 14 weeks, $3,477,632.
Calamine value, the week, $4845; 14 weeks, $143,093.
Lead value, the week, $58,449; 14 weeks, $696,657.

NEW CALEDONIA ORES

Exports of ores from New Caledonia for the year ended Dec. 31 are reported as below, in metric tons:

	1909	1910	1911	1912
Nickel ore	82,028	115,342	120,059	74,312
Chrome ore	32,136	28,244	32,806	51,516
Nickel matte	....	768	2,993	5,908

The nickel matte exported contains from 40 to 45% nickel. In 1909 there were 69 tons of cobalt ore exported, but none has been mined since that date. A little copper ore was exported in 1909 and a few tons of iron ore in 1910. The larger exports of nickel ore were to England, Germany and Belgium; of chrome ore to Germany and the United States.

IRON TRADE REVIEW

NEW YORK—April 9

In the western districts where work was interfered with by the floods, production is being resumed and repairs made. Most of the districts in the Mahoning Valley and around Pittsburgh appear to be taking matters cheerfully and getting in order for renewed production with little delay. The actual damage done does not seem to have been large, and it is hoped that mills will work up to a maximum production again in a very short time.

The pig-iron market is firmer, especially for basic iron, which seems to be in larger demand. Foundry iron is rather quiet for the present. The furnaces which were banked on account of short supply of coke are getting into order again, and the number blown out altogether is not large.

It is reported by cable that some large orders for tinplates have been placed with the Welsh mills by American concerns. This is believed to be due to the impossibility of getting prompt deliveries from American mills.

The reduction in duties proposed by the new tariff bill is the subject of general discussion. It is not believed, however, that the reductions will make any considerable difference in the trade under existing conditions here and abroad.

Exports and Imports in Great Britain of iron and steel, and of manufactures thereof, two months ended Feb. 28, are valued as follows:

	Exports	Imports	Excess
Iron and steel	£8,866,659	£2,683,229	Exp. £6,183,430
Machinery, etc	8,989,223	2,481,728	Exp. 6,507,495
Total	£17,855,882	£5,164,957	Exp. £12,690,925
Total, 1912	16,068,312	4,259,962	Exp. 11,808,350

Quantities of iron and steel exported this year were 786,218 long tons; imported 397,132 tons; against 780,692 and 325,736 tons last year.

PITTSBURGH—Apr. 8

Furnaces and mills in the districts affected by flood have been resuming about as rapidly as was expected, the average time lost being about a week for blast furnaces and a trifle less than two weeks for steel works. As to railroad service, conditions have proved much better than was expected, for the early reports of damage to railroad property suggested that after the furnaces and mills were gotten into condition for resumption their operation would be much impeded by insufficient transportation facilities. The railroads were not damaged as badly as expected, and they have shown remarkable energy and ability in resuming transportation. There is now very little difficulty in freight movement, as to the commodities which must be moved if production is to be continued. There is much car shortage, particularly of box cars, but this merely accumulates some material temporarily in mill warehouses.

As reported last week, the capacity affected represented close to 30% of the country's total capacity, in both pig iron and steel. In tonnage, the total loss runs somewhat above a quarter million tons, and not all of this has yet been experienced, since most of the plants affected are not yet running up to their rate before the flood. Some of the blast furnaces resumed slowly, on account of having become partly chilled, but only two or three furnaces were lost. At steel

works and rolling mills the cleaning up was done very expeditiously, but in several cases resumptions were delayed by trouble with electrical apparatus.

The iron and steel markets have shown little effect from the floods. Coke has been somewhat weak, but not as weak as expected. It is not authenticated that standard coke has sold at less than $2.25, but it is suspected that some sales have been made at $2 or $2.15. Pig iron has not picked up, and presents no definite market. Finished-steel products are somewhat strengthened in general, and there is a decided accretion of strength in tinplates and sheets. The wire trade is expected eventually to be benefitted very materially, though thus far no effect has been felt. The production lost in sheets and tinplates was particularly heavy, and in addition to this, or perhaps because of knowledge of it on the part of buyers, specifications have been very heavy in the past week.

Pig Iron—The local pig-iron market has not really opened up since the flood, remaining practically stagnant. If anything, it is quieter than before the flood, although nothing occurred which ought definitely to depress the market. The production of merchant iron has been little affected. The Valley furnaces lost from two to ten days in output, while one furnace was chilled and had to be blown out. We repeat former quotations: Bessemer, $17; basic, $16; No. 2 foundry, $16.25; forge, $15.75; malleable, $16.25, f.o.b. Valley furnaces, 90c. higher delivered Pittsburgh.

Ferromanganese—Yielding perhaps to continued shading of the $65 price, the regular asking figure has been reduced $4 a ton to $61, Baltimore. An advance in the old rate of $1.95 from Baltimore to Pittsburgh, to $2.30, was undertaken by the Baltimore & Ohio and Pennsylvania roads, but the Lake Erie, having a channel opened by the Wheeling & Lake Erie extension, has named a rate of $2, to be effective April 10, and the other roads will meet this figure.

Steel—There was practically no market in billets and sheet bars before the flood, and there is still less now, as steel producing capacity was hit hard by the floods.

Sheets—The leading interest has been starting mills and this week is operating 70% of its total sheet mills, against an average of 85% before the flood. Nearly all the independents closed by flood have resumed, but in several instances the finishing departments are engaged in reconditioning material touched by water and hot mills are kept idle until this material is out of the way. Specifications have been heavy. The market is very stiff, and cut prices have entirely disappeared. We quote the market at 1.75c. for blue annealed, 2.35c. for black and 3.50c. for galvanized.

IRON ORE

All arrangements are in hand for an early opening of Lake navigation. Estimates of shipments run as high as 50,000,000 tons for the season, and it is quite probable that the tonnage handled will approach that figure.

There is no change in Lake ore prices, which remain as fixed: Besemer ores, base 55% iron and under 0.45 phosphorus, Old Range, $4.40 and Mesabi $4.15 per ton; non-bessemers, base 51.5% iron, Old Range, $3.60 and Mesabi, $3.40 per ton; all at Lake Erie ports.

COKE

The coke market is rather slow in getting into shape. Production, which was interrupted by the floods, is coming up again slowly, and the transportation question is still a good deal of a problem. There has been practically no change in prices, as higher prices would not secure deliveries. Shipments will not be up to the normal for two or three weeks to come.

Anthracite Shipments in March were 4,909,288 long tons. For the three months ended March 31 they were 18,209,231 tons in 1912, and 16,919,876 in 1913; a decrease of 1,289,355 tons.

CHEMICALS

NEW YORK—April 9

The general market is rather quiet with only a moderate business, dealers being rather disposed to wait the action of Congress on the chemical schedules in the new tariff bill.

Arsenic—The market has been without feature, demand being rather light, with sufficient supplies. Current quotations are $4@4.25 per 100 lbs for white arsenic.

Copper Sulphate—Business is quiet but fairly steady, and prices are unchanged at $5.25 per 100 lb. for carload lots and $5.50 per 100 lb. for smaller parcels.

Nitrate of Soda—Business is steady, but without any special activity. Quotations remain about the same, 2.62½c. per lb, being asked for April, 2.60c. for May, 2.57½c. for June, and 2.55c. per lb. for July and later deliveries.

PETROLEUM

The monthly report of the "Oil City Derrick" shows new wells completed in March as follows: Pennsylvania grade, 548; Lima-Indiana, 82; Kentucky, 9; Illinois, 90; Kansas-Oklahoma, 552; Texas-Louisiana, 130; total, 1411, or 15 less than in January. The aggregate daily production of the new wells was 68,881 bbl. There were 116 gas wells and 252 dry holes reported.

COPPER SMELTERS' REPORTS

This table is compiled from reports received from the respective companies, except in the few cases noted (by asterisk) as estimated, together with the reports of the U. S. Dept. of Commerce as to imported material, and in the main represents the crude copper content of blister copper, in pounds. In those cases where the copper contents of ore and matte are reported, the copper yield thereof is reckoned at 95%. In computing the total American supply duplications are excluded.

	Dec.	Jan.	Feb.	March
Alaska shipments	3,766,029	1,668,328	660,250	.....
Anaconda	23,400,000	21,000,000	21,250,000	22,900,000
Arizona, Ltd	3,100,000	3,100,000	3,000,000	3,200,000
Copper Queen	8,805,568	7,554,966	6,810,706	7,558,709
Calumet & Arizona	5,840,000	4,750,000	4,050,000	.....
Chino	3,368,850	2,903,030	3,813,998	4,449,884
Detroit	2,389,875	1,769,071	1,689,277	1,640,671
East Butte	1,314,021	1,469,000	.....	.....
Mammoth	1,850,000	.....	.....	.....
Giroux	625,000	.....	.....	.....
Mason Valley	1,550,000	1,575,100	.....	.....
Nevada Con.	3,975,631	4,169,705	4,798,531	.....
Ohio	566,816	.....	.....	.....
Old Dominion	2,727,000	2,727,000	2,381,000	2,853,000
Ray	3,638,500	3,610,000	3,610,000	4,287,400
Shannon	1,361,420	1,232,000	1,152,000	1,260,000
South Utah	*nil*	.....	.....	.....
United Verde*	3,000,000	2,900,000	2,750,000	.....
Utah Copper Co	5,676,484	7,182,495	7,585,303	.....
Lake Superior*	18,300,000	17,500,000	19,000,000	19,000,000
Non-rep. mines*	7,750,000	7,500,000	.....	.....
Total production	103,005,194	.....	.....	.....
Imports, bars, etc	28,761,087	34,026,236	.....	.....
Total blister	131,766,281	.....	.....	.....
Imp. in ore and matte	10,385,662	7,563,758	.....	.....
Total American	142,151,943	.....	.....	.....
Miami†	2,913,840	2,932,369	2,817,200	3,102,200
Brit. Col. Cos.:				
British Col. Copper	.....	.....	.....	.....
Granby	.....	1,792,245	1,740,000	2,020,462
Mexican Cos.:				
Boleo†	2,480,240	2,658,880	2,535,680	.....
Cananea	5,592,000	.....	4,880,000	4,772,000
Moctezuma	2,793,781	2,913,294	2,730,914	3,062,159
Other Foreign:				
Braden, Chile	910,000	1,484,000	1,178,000	.....
Cape Cop., S. Africa	750,560	770,540	.....	.....
Kyshtim, Russia	1,489,600	1,644,160	.....	.....
Spassky, Russia	974,400	974,400	1,003,520	.....
Exports from				
Chile	7,392,000	6,752,000	5,824,000	.....
Australia	9,856,000	9,744,000	5,512,000	.....
Arrivals in Europe‡	16,363,200	17,689,280	8,509,760	.....

† Boleo copper does not come to American refiners. Miami copper goes to Cananea for treatment, and reappears in imports of blister.

‡ Does not include the arrivals from the United States, Australia or Chile.

STATISTICS OF COPPER

	United States			Visible Stocks.		
Month	U.S.Refin'y Production	Deliveries, Domestic	Deliveries, for Export	United States	Europe	Total
III, '12	125,694,601	67,487,466	58,779,566	62,939,988	141,142,400	204,082,387
IV	125,464,644	69,513,846	53,252,326	62,367,557	136,819,200	199,186,757
V	126,737,836	72,702,277	69,485,945	695,066,02	134,176,000	199,242,029
VI	122,315,240	66,146,229	61,449,650	49,615,643	117,801,600	167,417,244
VII	137,161,129	71,094,381	60,121,331	44,335,004	108,186,000	152,521,003
VIII	145,628,521	78,722,418	70,485,150	50,280,421	113,299,200	163,579,621
IX	140,089,819	63,460,810	60,264,796	46,701,374	113,568,000	160,269,374
X	145,405,453	84,104,734	47,621,342	63,065,587	107,408,000	170,473,587
XI	134,695,400	69,369,795	55,906,550	76,744,964	103,801,600	180,546,564
XII	143,354,042	58,491,723	65,713,796	86,164,059	96,947,200	183,111,259
Year, 1912	1,581,920,287	819,665,948	746,396,452	.....	.....	.....
I, 1913.	143,479,625	65,210,030	60,383,845	105,312,582	78,491,840	183,904,422
II	130,948,881	59,676,492	72,168,523	123,198,332	77,504,000	200,702,332
III	136,251,849	76,585,471	77,699,306	122,302,890	81,244,800	203,547,690
IV	.....	.....	.....	104,269,270	87,180,800	191,450,070

Note—From Jan. 1, 1913, visible supplies in Europe do not include copper afloat.

Assessments

Company	Delinq	Sale	Amt.
Atlas Wonder, Nev.	Apr. 21	May 14	$0.01
Caledonia, Nev.	Apr. 9	Apr. 29	0.05
Cariboo, Ida.	Apr. 5	May 1	0.01
Central Eureka, Calif.	Mar. 22	Apr. 26	0.02½
Challenge, Nev.	Apr. 1	Apr. 22	0.05
Chollar, Nev.	Mar. 31	Apr. 24	0.03
Columbus Extension, Utah.	Apr. 19	Apr. 26	0.02
Con. Virginia, Nev.	Apr. 23	May 14	0.15
Corbin Copper, Mont.	.....	Apr. 22	0.50
Crown Point, Utah.	Mar. 20	Apr. 15	0.01
East Hercules Ext., Ida.	Apr. 15	.....	0.001½
Great Falls, Utah.	Mar. 22	Apr. 22	0.01
Gypsy Queen, Nev.	Mar. 31	May 5	0.01
Lehi Tintic, Utah.	Apr. 15	May 7	0.01
Little Cottonwood, Utah.	Apr. 17	May 8	0.01
Michigan Cop. & Gold, Utah	Mar. 31	Apr. 22	0.01
National Copper, Ida.	Mar. 13	Apr. 14	0.01
O. K. Silver, Utah.	Apr. 15	May 10	0.01
Ophir, Nev.	Apr. 16	May 8	0.15
Pioneer Cons., Ariz.	Apr. 1	Apr. 23	0.005
Seg. Belcher, Nev.	Apr. 8	Apr. 29	0.02
Sierra Nevada, Nev.	Apr. 2	Apr. 23	0.10
Smuggler, Utah.	Mar. 16	Apr. 16	0.01
Snowstorm Ext., Ida.	Mar. 20	Apr. 19	0.003
Wandering Jew, Utah.	Mar. 31	Apr. 21	0.01

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1911	1912	1913	1911	1912	1913
January	53.795	56.260	62.938	24.865	25.887	28.983
February	52.222	59.043	61.642	24.081	27.190	28.357
March	52.745	58.375	57.870	24.324	26.875	26.669
April	53.325	59.207	.....	24.595	27.284	.....
May	53.308	60.880	.....	24.583	28.038	.....
June	53.043	61.290	.....	24.486	28.215	.....
July	52.630	60.654	.....	24.286	27.919	.....
August	52.171	61.606	.....	24.082	28.375	.....
September	52.440	63.078	.....	24.209	29.088	.....
October	53.340	63.471	.....	24.594	29.299	.....
November	55.719	62.792	.....	25.649	29.012	.....
December	54.905	63.365	.....	25.349	29.320	.....
Year	53.304	60.835	.....	24.592	28.042	.....

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

	New York				London, Standard	
	Electrolytic		Lake			
	1912	1913	1912	1913	1912	1913
January	14.094	16.488	14.337	16.767	62.760	71.741
February	14.084	14.971	14.329	15.253	62.893	65.519
March	14.698	14.713	14.868	14.930	65.884	65.329
April	15.741	.....	15.930	.....	70.294	.....
May	16.031	.....	16.245	.....	72.352	.....
June	17.234	.....	17.443	.....	78.259	.....
July	17.190	.....	17.353	.....	76.636	.....
August	17.498	.....	17.644	.....	78.670	.....
September	17.508	.....	17.698	.....	78.762	.....
October	17.314	.....	17.661	.....	76.389	.....
November	17.326	.....	17.617	.....	76.890	.....
December	17.376	.....	17.600	.....	75.516	.....
Year	16.341	.....	16.560	.....	72.942	.....

New York, cents per pound, London, pounds sterling per long ton of standard copper.

TIN

Month	New York		London	
	1912	1913	1912	1913
January	42.529	50.298	191.519	238.273
February	12.962	48.766	195.036	220.150
March	12.577	46.832	192.619	213.645
April	43.923	.....	200.513	.....
May	16.063	.....	208.830	.....
June	45.815	.....	205.863	.....
July	44.519	.....	202.446	.....
August	45.857	.....	208.351	.....
September	49.135	.....	223.762	.....
October	50.077	.....	228.353	.....
November	49.891	.....	227.619	.....
December	49.815	.....	226.875	.....
Av. year	46.096	.....	209.322	.....

New York in cents per pound; London in pounds sterling per long ton.

LEAD

Month	New York		St. Louis		London	
	1912	1913	1912	1913	1912	1913
January	4.435	4.321	4.327	4.171	15.597	17.114
February	4.026	4.325	3.946	4.175	15.738	16.550
March	4.073	4.327	4.046	4.177	15.997	15.977
April	4.200	.....	4.118	.....	16.331	.....
May	4.194	.....	4.072	.....	16.509	.....
June	4.392	.....	4.321	.....	17.588	.....
July	4.720	.....	4.603	.....	18.544	.....
August	4.569	.....	4.452	.....	19.655	.....
September	5.048	.....	4.924	.....	22.292	.....
October	5.071	.....	4.894	.....	20.630	.....
November	4.615	.....	4.463	.....	18.193	.....
December	4.303	.....	4.152	.....	18.069	.....
Year	4.471	.....	4.360	.....	17.929	.....

New York and St. Louis cents per pound. London, pounds sterling per long ton.

SPELTER

Month	New York		St. Louis		London	
	1912	1913	1912	1913	1912	1913
January	6.442	6.931	6.292	6.854	26.642	26.114
February	6.499	6.239	6.349	6.089	26.661	25.338
March	6.626	6.078	6.476	5.926	26.048	24.605
April	6.633	.....	6.483	.....	25.644	.....
May	6.679	.....	6.529	.....	25.790	.....
June	6.877	.....	6.727	.....	25.763	.....
July	7.116	.....	6.966	.....	26.174	.....
August	7.028	.....	6.878	.....	26.443	.....
September	7.454	.....	7.313	.....	27.048	.....
October	7.426	.....	7.276	.....	27.543	.....
November	7.371	.....	7.221	.....	26.804	.....
December	7.162	.....	7.081	.....	26.494	.....
Year	6.943	.....	6.799	.....	26.421	.....

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

PIG IRON IN PITTSBURG

	Bessemer		Basic		No. 2 Foundry	
	1912	1913	1912	1913	1912	1913
January	$15.12	$18.15	$13.32	$17.35	$14.00	$18.59
February	15.03	18.15	13.28	17.22	14.01	18.13
March	14.95	18.15	13.66	16.96	14.10	17.53
April	15.13	.....	13.90	.....	14.15	.....
May	15.14	.....	13.90	.....	14.12	.....
June	15.15	.....	14.11	.....	14.22	.....
July	15.15	.....	14.38	.....	14.38	.....
August	15.43	.....	14.90	.....	14.85	.....
September	16.86	.....	16.03	.....	15.63	.....
October	17.90	.....	17.18	.....	17.22	.....
November	18.07	.....	17.09	.....	18.00	.....
December	18.15	.....	17.45	.....	18.73	.....
Year	$16.01	.....	$14.93	.....	$15.28	.....

STOCK QUOTATIONS

COLO. SPRINGS Apr. 8

Name of Comp.	Bid.
Acacia	.02
Cripple Cr'k Con.	.01½
C. K. & N.	.10
Doctor Jack Pot.	.06½
Elkton Con.	.59½
El Paso	4.80
Findlay	.04½
Gold Dollar	.10
Gold Sovereign	.02½
Isabella	.11
Jack Pot	.05½
Jennie Sample	‡.01
Lexington	‡.008
Moon Anchor	‡.005
Old Gold	.02½
Mary McKinney	.63
Pharmacist	.01
Portland	.98
Vindicator	96
Work	‡.004

SALT LAKE Apr. 8

Name of Comp.	Bid.
Beck Tunnel	.10
Black Jack	‡.09
Cedar Talisman	.02
Colorado Mining	.13
Columbus Con.	.05
Crown Point	.03½
Daly-Judge	‡6.50
Grand Central	77
Iron Blossom	1.45
Little Bell	‡.35
Lower Mammoth	.03
Mason Valley	7.00
May Day	.11½
Nevada Hills	1.00
New York	‡.005
Prince Con	62
Silver King Coal'n	3.00
Sioux Con	.03½
Uncle Sam	.07
Yankee	.11

TORONTO Apr. 8

Name of Comp.	Bid	Name of Comp.	Bid
Bailey	.09	Foley O'Brien	.28
Coniagas	8.00	Hollinger	17.50
T. & Hudson Bay	‡64.00	Imperial	.04
Timiskaming	.36	Jupiter	.53
Wettlaufer-Lor.	.13½	Pearl Lake	.57
Apex	‡.02½	Porcu. Gold.	.24
Crown Chartered	.01	Preston E. D.	‡.04
Dobie	‡.15	Rea	.30
Dome	‡17.50	Swastika	.11½
Dome Exten.	.11	West Dome	‡.24

SAN FRANCISCO Apr. 8

Name of Comp.	Clg.	Name of Comp.	Bid
COMSTOCK STOCKS		MISC. NEV. & CAL.	
Alta	‡.01	Belmont	6.45
Belcher	.18	Jim Butler	1.05
Best & Belcher	.05	MacNamara	.22
Caledonia	.07½	Midway	.54
Challenge Con.	.07	Mont.-Tonopah	1.77½
Chollar	.03	North Star	.33
Confidence	‡.35	West End Con.	1.32½
Con. Virginia	.15	Atlanta	.16
Crown Point	.16	Booth	.06
Gould & Curry	.02	C.O.D. Con.	.05
Hale & Norcross	.06	Comb. Frac.	.06
Mexican	.77	Jumbo Extension	.24
Occidental	.70	Pitts.-Silver Peak	.50
Ophir	.15	Silver Pick	.07
Overman	.35	St. Ives	.30
Potosi	‡.02	Tramp Con.	‡.01
Savage	.05	Argonaut	2.00
Sierra Nevada	.35	Bunker Hill	1.50
Union Con.	.13	Central Eureka	.16
Yellow Jacket	.22	So. Eureka	2.75

N. Y. EXCH. Apr. 8

Name of Comp.	Clg.
Amalgamated	78⅜
Am. Agri. Chem.	54
Am.Sm.&Ref.,com	72
Am. Sm. & Ref., pf.	104½
Am. Sm. Sec., pf. B	86
Anaconda	39⅜
Batopilas Min.	1¼
BethlehemSteelpf	72½
Chino	42⅞
Federal M. & S., pf.	34
Goldfield Con.	2½
GreatNor.,ore,ctf.	37
Guggen. Exp.	47¾
Homestake	100
Inspiration Con.	18½
Miami Copper	24½
Nat'nalLead,com.	51
National Lead, pf.	105½
Nev. Consol.	18¼
Phelps Dodge	200
Pittsburg Coal, pf.	84
Ray Con.	19½
RepublicI&S.com.	27
Republic I & S, pf.	85⅝
SlossSheffi'd,com.	36
Sloss Sheffield, pf.	92
Tennessee Copper	37⅜
Utah Copper	54¾
U. S. Steel, com.	63⅝
U. S. Steel, pf.	108
Va.Car. Chem., pf.	108

N. Y. CURB Apr. 8

Name of Comp.	Clg.
Barnes King	‡.95
Beaver Con.	.37
Braden Copper	.87⅞
B. C. Copper	3⅛
Buffalo Mines	2 1/16
Caledonia	‡.40
Con. Ariz. Sm.	⅛
Davis-Daly	2⅛
Diam'field-Daisy	.05
Ely Con.	.10
Florence	.51
Giroux	3
Gold Hill Con.	‡⅛
Greene Cananea	7¾
Greenwater	.05
Internat. S. & R.	‡117
Kerr Lake	3 3/16
Keystone	‡2
La Rose	2¾
McKinley-Dar-Sa.	1 13/16
Min. Co. of A. new	3
Motherlode Gold.	‡.60
Nev. Utah M. & S.	‡.01
Nipissing Mines	9¼
Ohio Copper	13/16
Pacific Sm. & M.	1/16
Puebla S. & R.	2⅛
South Live Oak	‡2
South Utah M. & S.	1/16
Standard Oil (Old)	‡1110
Stand'd Oil of N.J.	370
Stewart	1⅝
Tonopah	5⅜
Tonopah Ex.	2 1/16
Tonopah Merger	1
Tri-Bullion	½
Tularosa	¾
Union Mines	‡1/16
United Cop., pfd.	10
Yukon Gold	2⅛

LONDON Apr. 8

Name of Com.	Clg.
Camp Bird	£0 19s 3d
El Oro	0 15 2
Esperanza	1 8 0
Mexico Mines	6 13 10
Oriental Con.	1 8 9
Oroville	0 5 8
Santa Gert'dis	1 4 8
Tomboy	1 4 2

BOSTON EXCH. Apr. 8

Name of Comp.	Clg.
Adventure	2½
Ahmeek	300
Algomah	1
Allouez	37
Am. Zinc	28⅞
Ariz. Com., ctfs.	4
Bonanza	.38
Boston & Corbin	6½
Butte & Balak	2
Calumet & Ariz.	68¼
Calumet & Hecla	480
Centennial	15¼
Cliff	1½
Copper Range	45¾
Daly West	3¼
East Butte	13
Franklin	6½
Granby	63½
Hancock	22½
Hedley Gold	33½
Helvetia	¼
Indiana	13
Island Cr'k, com.	54
Island Cr'k, pfd.	84
Isle Royale	26½
Keweenaw	2
Lake	16¼
La Salle	4⅞
Mass	5
Michigan	2
Mohawk	53½
New Arcadian	2¼
New Idria Quick.	3⅞
North Butte	30⅜
North Lake	1½
Ojibway	2
Old Dominion	50
Osceola	93
Quincy	72
Shannon	11¼
Shattuck-Ariz.	24
Superior	33½
Superior & Bost.	3⅜
Tamarack	34¾
Trinity	4½
Tuolumne	2¾
U. S. Smelting	41¼
U. S. Smelt'g, pf.	48½
Utah Apex	1¾
Utah Con.	9
Victoria	1⅛
Winona	2⅛
Wolverine	62½
Wyandot	1

BOSTON CURB Apr. 8

Name of Comp.	Last
Alaska Gold M.	14⅛
Bingham Mines	4
Boston Ely	.65
Boswyocolo	‡.01
Butte Central	2⅜
Cactus	13
Calaveras	2⅞
Chief Cons	1⅜
Corbin	.66
Cortez	⅛
Crown Reserve	3⅞
Eagle & Blue Bell	1
First Nat. Cop.	2½
Majestic	42
Mexican Metals	1⅜
Moneta Porc.	‡.06
Nevada-Douglas	2 7/16
New Baltic	1⅛
Oneco	1⅜
Raven Copper	.15
Rhode Island Coal	.07
Smokey Dev.	1⅜
S. W. Miami	3½
South Lake	7
Tretheway	.40
United Verde Ext.	⅜

‡Last quotation.